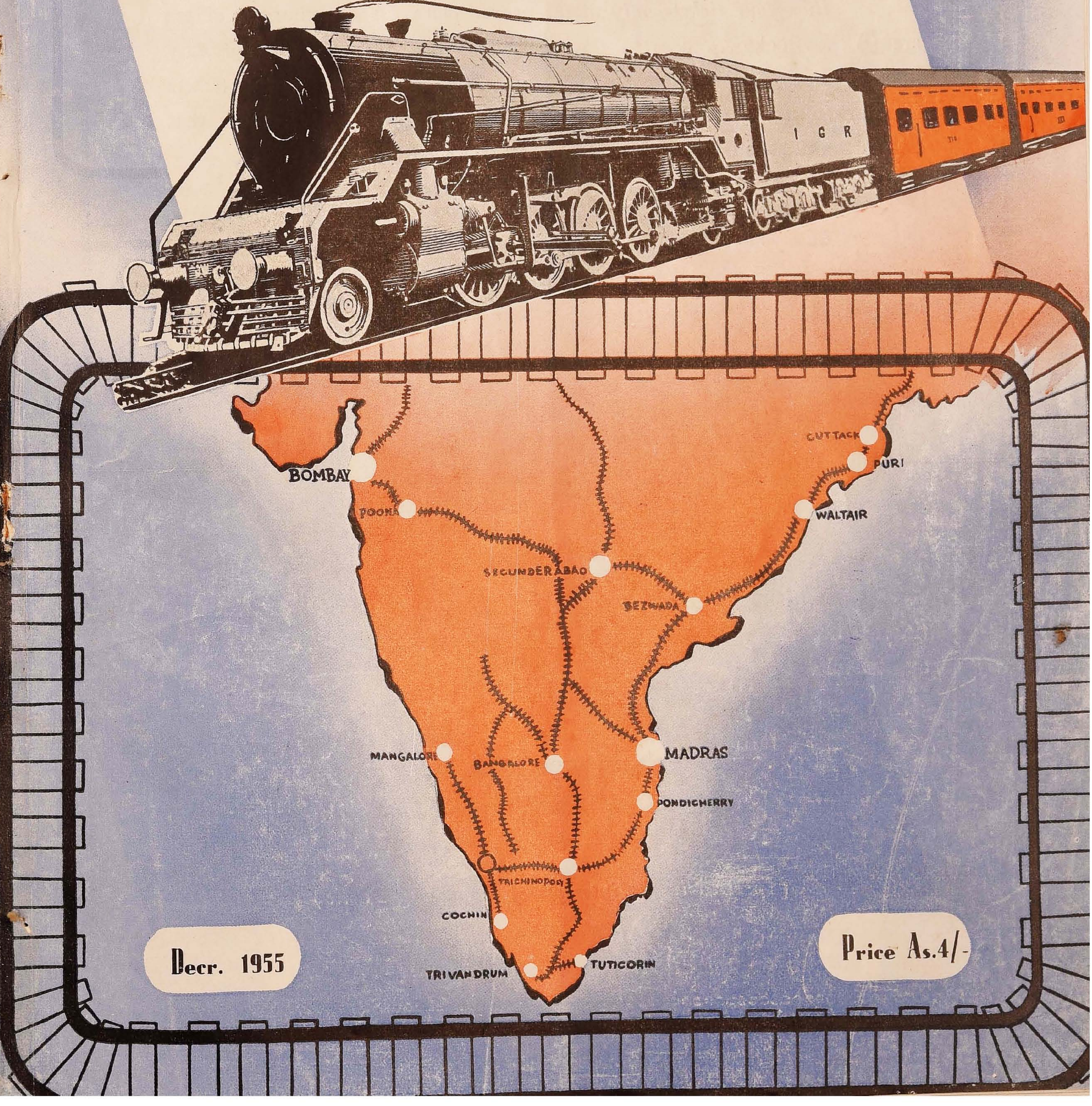
295
1.56

SOUTHERN RAILWAYS *Magazine*

OFFICE OF THE REGISTRAR OF BOOKS
JAN 1956
MADRAS



Decr. 1955

Price As.4/-

IN YOUR OWN INTERESTS

HOW TO PURCHASE TICKETS

Buy your tickets only at the proper place. The authorised offices are (i) the Booking offices at the railway stations, (ii) the Town or City Booking Offices, (iii) the out-Agencies, (iv) Travel Agents. Never buy tickets from any other source as that may lead you to trouble. Please note that tickets are not transferable.

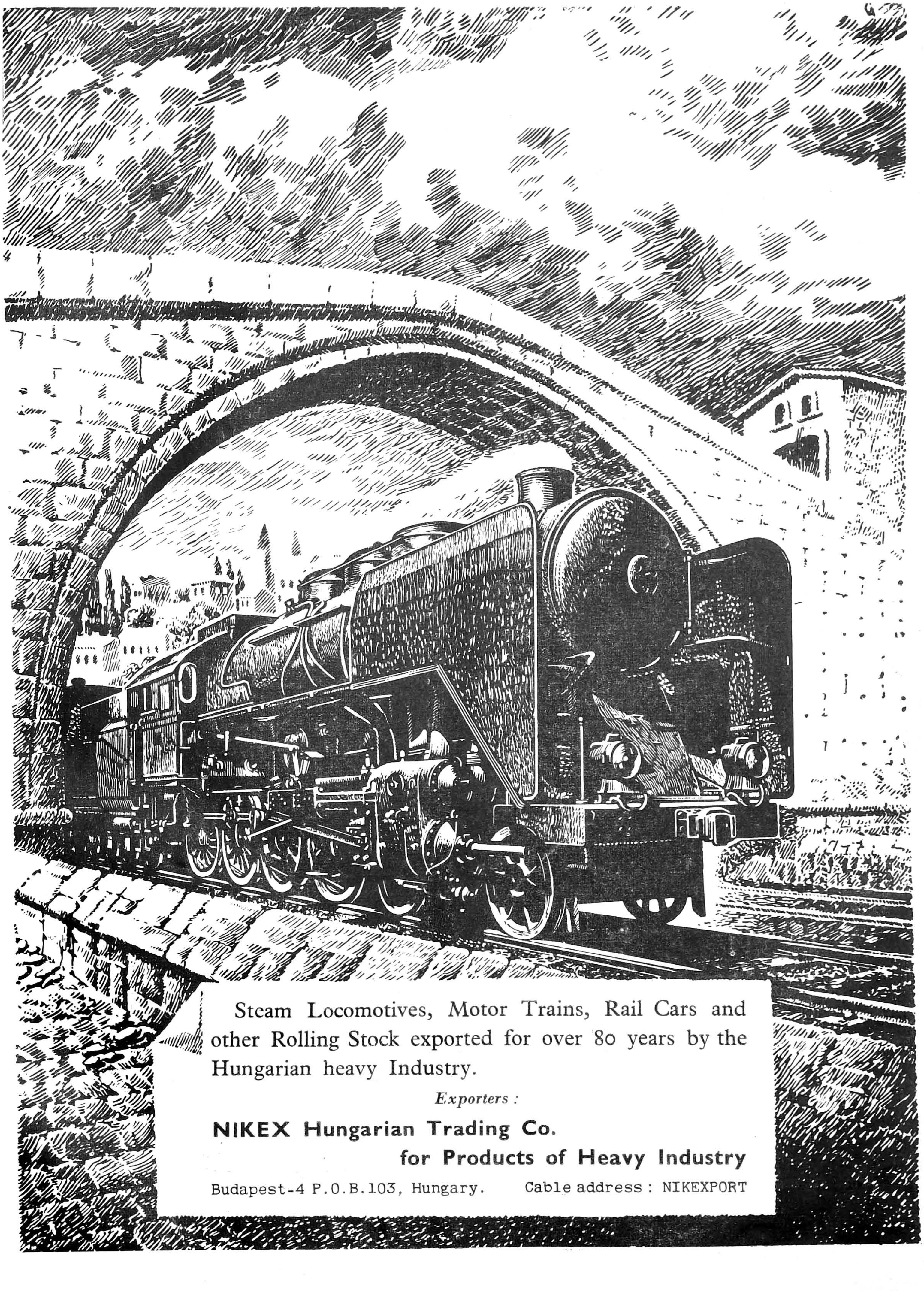
Buy your tickets in the proper time. You can avoid unnecessary excitement and trouble if you come to the station in good time, that is at least half an hour before the scheduled departure of your train. The Time Tables of the Railway are on sale at Booking Offices and Bookstalls.

Buy your tickets in the proper manner. Queue up at the Booking Window and you can get your ticket easier and quicker than by crowding at the counter.

By handing in the *exact fare in good coins or currency* you get the ticket easier and quicker, and save for yourself and the Booking Clerk time and trouble.

Check up your ticket and money before leaving the counter and draw the attention of the Booking Clerk to any discrepancy you may notice.

(Inserted in the interests of Travelling Public)


Steam Locomotives, Motor Trains, Rail Cars and other Rolling Stock exported for over 80 years by the Hungarian heavy Industry.
Exporters :
NIKEX Hungarian Trading Co.
for Products of Heavy Industry
Budapest-4 P.O.B.103, Hungary.
Cable address : NIKEXPORT

RADIO AND TELEVISION

New Fields of Enterprise for Danish Industrialists

DURING the nineteenth century Denmark has fostered several outstanding men, besides Hans Christian Andersen, the story-teller. One of them also carried the names Hans Christian, but with the surname Oersted attached. In a way, he too, contributed largely to the story-telling in the world, as he discovered the relationship between electricity and magnetism and thus laid the foundation to what should become—a century afterwards—the most popular household utensil in the 20th century, radio and television.

He made his discovery as early as in 1820. As many great discoveries it was made accidentally. However, Oersted had a notion of the tremendous implications of his discovery. He spent many years working with electromagnetism, and he is the founder of the department of electro-technical science that has to do with electro-magnetism. If Hans Christian Oersted could revisit this earth and see with his own eyes what extent his discovery and his science have been put to practical use, he would certainly be surprised in spite of all that his own imagination might have led him to anticipate.

Towards the end of the same century, another Dane invented the electro-magnetic sound-reproducing machine, the telegraphone. He was Valdemar Poulsen. In co-operation with compatriot, P. P. Pedersen, an engineer, he also invented the arc generator which was the indispensable prerequisite for telegraph and radio communication.

With such and similar achievements to point to, it is hardly surprising that electro-technical science has a large following in Denmark. It appears, not least, from the great number of students at technical colleges who go in for this science, and from the great number of young people seeking into the radio trade and radio manufacturing. Radio as a mass communications means is hardly thirty years old. Yet to-day Denmark has more than 50 important enterprises in the field, employing 20,000 people.

The Danish radio industry can meet any demand from the radio market. Its manufactured products range from the smallest part of a wireless set to large radio gramophones and television sets. Further, they carry out important research in their own laboratories, and many efforts are directed towards the single purpose of keeping abreast with the novelties in this ever changing technical field. In connection with this work it should be noted that a close co-operation exists between Danish radio scientists and their colleagues in other countries.

In 1944 the Danish radio industry co-operated with the Academy for Technical Sciences and the Royal Technical University in setting up a Radio Technical Research Laboratory staffed with highly qualified technicians. To-day, this laboratory is one of the best equipped television laboratories in Europe, and the results of its research work and experiments are made available to the whole Danish industry.

This year—1954—an American woman journalist coming home from a trip which had, among other countries, included Denmark, told her readers that the Danes had tried out television, but they had become tired of it, and now it was being given up. This is very far from the truth.

The Danish radio is government controlled and operates on a license system. It is broadcasting two daily programs. In 1951, a TV department was established, and after two yerrs of experimenting television was given green light as from January 1954. Since then, its programs have been greatly expanded, and the number of TV fans is slowly going up. New and very modern equipment was taken into use during 1954. Specially equipped cars will permit direct telecasting of outdoor and indoor activities, and plans have been made to cover all Denmark with television in the course of about four years. Judging by this development, televisions has come to Denmark in order to stay, and this is even clearer when turning to the television industry.

Ten of the largest Danish radio factories have started a successful mass production of TV sets. Most of these factories have more than 25 years of experience in the manufacturing of radio sets and components. After the inevitable period of trial by error, which is the lot of any new enterprise, they now manufacture and sell TV sets of very high quality at very reasonable price.

Several factories have concentrated on the manufacturing of certain TV set components. The receiver is

(Continued on page 3)

THE STORY OF HARRINGTON

By R. E. Crawford

AS THE RECENT war drew to a close, Canada's tool shops faced a grim future. They had sprung up by the score, they had done a magnificent job in meeting the emergency, by Canada's future, no matter how promising, would not for many years need enough tools and dies to keep them all going. One of the firms that did something about it at the end of hostilities was Harrington Tool & Die Co., of Lachine, near Montreal. Switching a good part of its operation to production of special machines, a few lines of small machine tool and a standard line of die sets and drill jig bushings, the company has also kept its tool and gauge departments active and work is provided for nearly 200 employees.

After the war, conversion was tackled actively; the staff never dropped below 125 and now stands at about 186. New machines were bought to do larger work than tool shop work—the largest machine in the plant is a 48″×48″×16′ planer.

Gauging and measuring equipment in the plant is very extensive and well catalogued, and appears like that of a national standard laboratory on a small scale, with master gauge blocks, super micrometers, optical projectors (one of which is set up on rails in a projection room to give a wide range of magnification) and there is cabinet after cabinet of gauging equipment of all types.

The company makes gauges and master cylindrical squares (the joke of sending an apprentice for a "round square" has now become a reality) for its own purposes and for sale. Custom physical inspection is done as a natural result of having these facilities to meet its own inspection needs.

The plant may be divided into six distinct operations under one roof—precision machinery, parts production, die sets, bushings, dies (including flatware dies), tools and gauges of all descriptions.

In the first group, stock items include punch presses, spinning lathes, toolroom grinders, buffing lathes and spindle sanders. To special order there have been built machines for wire stranding, cable wrapping and coil winding, also for bottle capping, razor blade grinding and wrapping, knife polishing and grinding, diamond drilling machinery. Machine tool rebuilding is also part of this department's work.

HIGH PRECISION MACHINERY

Most precise requirements have been met in the manufacture of a multitude of machines used in the production of needles for the knitting trade (the majority of the components on these machines were held within plus or minus .0002 in.) The same may be said of requirements being met for high-speed transmission machinery, and primary evacuating machines for electric lamp production. Some of these evacuating machines, of oil-hydraulic piston design, operate to less than six microinches of mercury (three millionths of an atmosphere).

The company has now acquired the North American rights for the manufacture of packaging, weighing and

---

(Continued from page 2)

subdivided in a number of constructional units the sum of which constitutes the complete receiver chassis. Among these units are the tuner, which is adjustable up to 12 channels; also the picture channel, and the sound channel. All of these are assembled with accessory components and adjusted ready for mounting. The complete set is made both to European and American standard.

As in many other export fields it is the craftmanship and ingenuity in design and production, which carry Danish radio and television equipment to markets all over the world. You may try to look at the trade marks of sets in Brazil and Argentina, in Spain and Egypt—yes, even in Afghanistan, and you will find the popular words "Made in Denmark" in quite a few of them While total exports of the Danish radio and television industry in 1951 was almost twenty times as big as in 1938, they had by 1954 expanded further and amounted to nearly 10 million Danish kroner.

filling machines of Machines Automatiques Bardet, of France.

One problem solved with spectacular success by the company was the production of lead screws in which the groove was straight-sided, .015 in. wide by $\frac{1}{8}$ in. deep. There were three different pitches in the length of the screw, which in the original design of the machine had to be made of metal in the normal soft condition. Harrington's now produce these screws ground from the solid hardened bar, and operating life has been increased from a matter of months to years.

The die division has made dies to manufacture such items as refrigerator cabinets and evaporators and the tiny elements of a zipper fastener, can openers, toys, radio and telephone units, and specializes on deep draw tools.

A scoring and blanking die for making the cardboard cases for cigarette papers was a challenge to the tool room—a three-station die with four rows abreast. All punches were built up individually; contrary to the usual practice punches were hardened (63–65 Rock-well C) and dies left soft. The major portion of the die was held to tolerances of .0002 in. both size and position.

TOOLS FOR SILVER FLATWARE

The company pioneered in developing a die design for the disposable aluminium pie plate which recently won such sudden popularity. This equipment has also been produced for customers in the United States. A large section of the die department is set up to handle tools for the flatware industry. Previous to 1945, Canada's silver flatware manufacturers were solely dependent on their own die sinkers to handle this special phase of die making. However, due to post-war expansion and consequent shortage of skilled die makers they found their own shops unable to keep up with the large consumption.

Harrington Tool & die undertook to train die makers specializing in this type of work. Nearly all were taken from the ranks of war veterans. In producing new concepts of die design and adding its facilities for duplicating, heat treating and finishing dies, this company has solved the tool problem for the flatware industry. It is the only Canadian company with a special department set up to handle their requirements, and has been able to earn U. S. dollars for Canada by being able to surmount the duty and sell competitively in the United States.

The die sets and drill jig bushings have become widely accepted in the major Canadian production industries, including automotive, aircraft and electrical. Manufacture of high-accuracy die sets is on a production line basis, with detail inspection throughout. A refinement in production methods in this departments is the use of dry ice to shrink the posts for force fit assembly in the bases. This ensures a tight permanent fit without any distortion of the body that might occur if a press fit were used.

In die set manufacture, to solve the problem of boring accurately spaced holes of correct diameter, parallel and square with the base, the company has designed its own duplex precision boring unit which may be excepted on the machine tool market any time.

The story of the company is largely the story of its founder and president, David Harrington. "Dave" started to serve his apprenticeship in Valleyfield when he was 11 years old. At 19 he was a toolmaker with Canadian Allis-Chalmers and served with several other companies in Quebec Province. He formed his own company, Rapid Tool & Die in 1914. This company made shell lathes, threading tools, small arms ammunition dies, hardware specialties and shipped thousands of expanding milling machine arbors to England.

With that company successfully in operation, and with a few hours left during the day, he joined the Montreal Ammunition Co., a firstwar subsidiary of Dominion Bridge Co., as a toolmaker, and within six months became superintendent.

After the war Rapid Tool & Die tooled up the Canadian production of Gray-Dort automobiles—including fenders, running boards, dash, floor pan and instrument panels. To get castings quickly for this work, Mr. Harrington acquired the Bessette Foundry in Iberville, Que.

In 1923 "Dave" sold out his interests in Rapid Tool and formed a new company, Dominion Die & Tool, which, in 1930, built a new plant in the present location. In the lean years following, garage work, construction equipment repair, manufacture of railway car brakes and fittings, kept the shop going with a small corner always devoted to toolmaking.

Manufacture of Wheels and Axles

SURAHAMMARS Bruks AB, Surahammar, Sweden, has specialised in the manufacture of wheels and axles for rolling stock since 1866, and supplies wheel pairs for passenger coaches, goods wagons, motor coaches, locomotives and tramcars for all existing track gauges. The work's production also includes and manufacture of elastic (resilient) wheels for tramcars and particularly light wheel pairs with hollow axles and hardened and tempered light wheel centres. The wheels are either forged and rolled in one piece (solid wheels) or built up of centres and tires.

Ore from the company's own mines is used to produce high grade pig iron low in sulphur and phosphorus, and the steelmaking plant possesses furnace equipment that can satisfy the most varied demands. Furnaces for the acid and basic open hearth processes, arc furnaces and high-frequency induction furnaces make it possible to produce the particular material which may be required by applying the most advantageous method of production. Wheel blanks, tyres and disc wheel centres are forged in hydraulic presses, one of which—a 7500 ton press—is the largest in northern Europe. The blanks are usually rolled in special rolling mills to exact dimensions. The axles are rolled and forged under hammers to exact tolerances and with ample reduction. The various parts of the wheel pairs, are machined and assembled in the wheel shop, which is of recent construction.

GENERAL DESCRIPTION OF A NEW ASSEMBLY METHOD

A new assembly method has now been introduced after several years of research work at Surahammar. The old method of manufacture is to shrink the tyres on to the wheel centres and to secure them with a locking ring, whilst the wheel is pressed on to the axle. The wheel seat and hub bore as well as the mating surfaces of the wheel centres and tyres are turned to the required surface finish and limits. It is stipulated that the final

(Continued from page 4)

In order to form a limited company, in 1940 the name was changed to Harrington Tool & Die Co., Ltd., Mr. Harrington's World War I experience in cartridge cases made him an authority on their tooling and production. The company tooled up plants for producing all sizes from .303 small arms ammunition to 4.7 cartridges, and was one of the main centres of tools, gauges and production for Canada's great achievements in that direction.

Almost unique in machine tool plans, one of Dave's right hand " men " during the expansion of the firm has been his daughter, Miss Pearl Harrington. Well schooled by her father in the management of the business, she holds the positions of vice-president and secretary-treasurer and takes a very active part in the company's operations.

WIDE INTERESTS

The company's interest in one way or another extends through offices held by its president to many Canadian industries. Mr. Harrington is president of the Devoe Electric Switch Co., Montreal, of Benedict-Proctor Co., Trenton, Ont., producers of silver hollowware, and of Radio Communications Equipment & Engineering, Ltd., Lachine, Que., manufacturers of electronic and communication equipment, as well as of a ship-operating company, Lakeshore Lines, which operates two excursion steamers on the waters adjacent to Montreal.

These varied interests represent some 700 jobs, nearly all in the higher skill brackets, for Canadians.

The company in April, 1953, entered the field of machine tool distribution and is the exclusive Canadian agent for the huge Ferrostaal A. G. organization, of Essen, Germany.

The Company is proud to be able to say that a large number of its employees are shareholders. All employees are made eligible for stock holding after being with the Company five years and it is noteworthy that most employees who are eligible have taken advantage of this opportunity.

The Company has developed a regular plan of machine tool replacement and modernization. In order to meet the constant demands for precision in its products, the machine tools in the plant are maintained at a high level of accuracy and to do this requires unceasing vigilance. One or more machines are constantly being overhauled in the machine tool assembly department. Records are kept to show the manner in which any machine tool is functioning. It is confidently hoped that by this procedure and by a realistic procurement of machine tools and above all by intelligent management based on a high *esprit de corps* that the problems of the future will be successfully met as they have been in the past.

pressure for pressing the wheel on the axle shall lie between a minimum and a maximum value, e. g. 7½—10 tons/inch of wheel seat diameter for railway wheel sets. This means for instance a pressure of 50–60 tons for the standard axle of the Swedish State Railways.

The process of pressing the wheels on to the axle gives rise to a number of factors difficult to control. One only need to point to the cold working and tearing of the surfaces taking place, this causing additional stresses in that part of the wheel set where the risk for fatigue fracture is already greatest. The increased speeds and axle loads are accompanied by a greater strain on railway material than before, and the method of pressing wheels on to the axles can no longer be considered to meet the requirements of our time.

Wheel seat cracks can to some extent be shown up by supersonic tests, but the final control is always carried out by inspection directly on the wheel seat after the wheel has been pressed off. One must therefore reckon with dismantling after a number of years' service, and if this is done by pressing the wheel off, the mating surfaces are destroyed.

Several of the disadvantages of the old method are avoided if the wheels are shrunk instead of pressed on. A shrinkage allowance of approximately 0.1% is used as a rule, which means that an ordinary wheel set with a 175 mm (6.9″) diameter shall have a difference in diameter between wheel seat and hub bore of 0.175 mm (0.007″). The wheel seat and hub bore must therefore be machined with limits of approximately+0.01 mm (0.0004″). This high degree of precision could earlier only be obtained by individual fitting, which is impossible to carry out in mass production. More modern and better machine tools have, however, made it practically and economically possible to obtain the desired tolerances in mass production. Another advantage of mass production is also gained hereby: full interchangeability of all components.

The dismantling of a wheel shrunk on must not be done by pressing it off, but this problem has been solved with the help of the Oil Pressure Assembly Method invented and developed by Erland Bratt, SKF. This method consists of forcing oil under pressure through grooves between the wheel seat and the hub bore, whereby the hub bore expands, so that the wheel can easily slide off the axle on the oil film without being damaged.

A shrunk on wheel sits securely on its seating, it may be mentioned as an example that a standard railway wheel of 175 mm hub bore and 180 mm length of hub shrunk on to an axle with 0.1% interference could not be moved during a pressing off test, until the pressure had exceeded 120 tons.

MACHINING OF AXLES AND WHEELS

The high degree of precision cannot be obtained by turning, and grinding the wheel seat, hub bore and mating surfaces of the centre and tyre was therefore introduced at the same time as Surahammar changed over to shrinking instead of pressing the wheel on to the axle. The grinding is carried out on three machines, all manufactured by LMV, Lidkoping, Sweden. The wheel seat, shoulders for the bearing seats, and journals are ground simultaneously in a centreless grinding machine. The inside of the tyres are ground in a second machine, and the bore and outside diameter of the wheel centres simultaneously in a third. All grinding is carried out with a tolerance of 0.01 mm (0.0004″). After grinding, the tyre is shrunk on to the wheel centre and secured by rolling a locking ring into a specially turned groove.

THE SHRINKING OF THE WHEEL ON TO THE AXLE

In order to shrunk on the wheel, this must be heated so that an increase in diameter of approximately 0.2 mm (0.008″) greater than the interference is obtained. For a 175 mm axle an increase in diameter of 0.375 mm (0.015″) is therefore suitable, which means a least temperature difference of 185°C between axle and wheel with a coefficient of expansion of 0.000012. When shrinking on hardened parts great care must be taken not to lower the hardness by too high a shrinking temperature. In this case 220°C is the highest permitted temperature, but for case hardened parts 200°C should not be exceeded.

For warming the wheels an electrically heated through-feed furnace is used in Surahammar. The furnace temperature is 220°C for ordinary railway wheels. The axle is clamped horizontally in a special jig before shrinking on the wheels. After the wheel has been taken out of the furnace the hub bore is carefully cleaned. The wheel is slung in a lifting device whose trolley is freely moveable in the direction of the axle on a track, which is adjusted to a position directly over the axle. A sprung hook supports the wheel, which facilitates mounting considerably as the wheel can be guided without great effort to prevent it dragging too much against the wheel seat. The jig is fitted with a precisely positioned stop on each end against which the wheel is placed on shrinking. The distance between the wheels can be obtained to limits of + 0.1 mm (0.004″) if required.

When shrinking the driving wheels for locomotives or gear wheels it is often of great importance that the angular error between the wheels on one axle is very small. This requirement is very hard to fulfil when pressing on wheels as they often turn relative to the axle on pressing due to uneven resistance. In the shrinking process the wheel is freely moveable during mounting and with suitable fixtures a tangential precision of +0.1 mm. measured on the periphery of the wheel can be obtained.

REMOVAL AND ADJUSTMENT OF WHEELS

The groove necessary for distributing the pressure oil is machined at the same time as the hub bore, and is placed in the stiffest part of the section if the hub is fairly symmetrical. The oil groove should be as shallow as possible with a smooth surface and well rounded edges. The oil pump is connected to a threaded hole (¼" B S P) positioned on the inside of the wheel centre, and the oil is pumped through a 5 mm (0.2") diameter hole down to the groove.

For removing a wheel the wheel set is placed in a wheel press in the usual way. The oil pump is connected and the oil (castor oil) is pumped into the hub until it comes out at both sides, after which the wheel is pressed off the axle. The oil pressure is maintained during removal by pumping slowly until the oil groove has passed the edge of the wheel seat. The required force for pressing off a wheel in this way amounts to only a few per cent of that required for removing a pressed on wheel.

In case not sufficient accuracy is obtained on mounting for example locomotive wheels and gear wheels even with the shrink method, adjustments can easily be made by pressing oil between the hub and wheel seat, after which the wheel may be carefully turned on or pushed along the axle. Experience has shown that there is no risk of oil remaining between the surfaces of the hub bore and wheel seat to weaken the strength of the joint.

As shown in the foregoing pages, the shrink method together with the pressure oil dismantling may also be used with advantage for other shrink connections than railway wheel sets. With this method it is possible to abandon to a great extent earlier keyed connections. Keyways cause unpleasant stress concentrations, and the new method shows therefore a considerable gain from the design point of view.

If the customers prefer it, Surahammar can still use the old method of pressing the wheels on the axles.

RESEARCH WORK ON RAILWAY WHEELS AND AXLES

Both manufacturers and purchasers of wheel pairs have always wanted to be able to measure and record the stresses and strains occurring in the different parts under service conditions. Fundamental investigations of these problems have been carried out since 1947 by Surahammar in co-operation with the Swedish State Railways and ASEA (Swedish General Electric Comp.), and this research work has led to very good results. Resistance strain gauges make it possible to obtain a large number of strain values from the outer surfaces of the axles and wheels. It proved difficult at first to transfer the very weak electrical impulses obtained to the instrument cabin in the railway coach, but a solution was found in a special slip ring assembly suspended under the car body and connected with the axle by a spiral tube, which was torsion stiff but stretchable and bendable. The journal stub of the wheel set is provided with a hole corresponding to the tube, which through a radial hole opens out inside the wheel web. The cables are taken through the holes in the axle and through the tube to the sliprings. In this way the wheel set is allowed to move relative to the slipring assembly without damaging or shaking it. The enormous accumulation of recorded measurements necessitated in the beginning much subsequent time-consuming work, but this was eliminated by a classifying impulse calculator, designed by ASEA. The measurements were as rule made on ordinary passenger trains on the lines Stockholm-Malmo-Gothenburg-Stockholm. A thorough description and discussion of this research work is given by K. Meldahl, ASEA, in the Bulletin of the International Railway Congress Ass., June 1953.

Form giving and material questions have also been thoroughly investigated. Tests have been made with models, and one of the findings was the fact that, if an axle is tapered down slightly in the middle, particular care being taken, however, that the transition to the hub has the proper contour, the fatigue strength of the wheel seats will be improved. Surahammar also has a fatigue-testing machine, designed and constructed at Surahammar for the full-scale testing of wheel pairs.

DANISH SHIPPING

IT has been ably said that the ideal state of affairs, from a shipowner's point of view, would be a world where only nine ships were available for carrying every ten cargoes. Danish shipowners who derive more than 80 per cent. of their income from trade between one foreign port and another would not go far as that. They would be happy and content in a world where free competition on fair and equal terms was the rule, so that shippers were at liberty to consign their goods by the vessel offering a fast and safe service at the most attractive terms. This, however, is far from being the case to-day.

The path of free shipping is indeed full of obstacles, most of them more harmful to their authors than to anybody else, but all the same exceedingly cumbersome to the free shipowner. First, there is the very different social level of the sailors under different flags. This is due partly to some countries like Denmark adhering to all the conventions sponsored by the International Labour Office, and some not; and partly to the position of the trade unions and similar organizations in Denmark (and most other traditionally seafaring countries) being sufficiently strong to secure a high level of wages and an advanced standard of working hours, manning, catering, and accommodation on shipboard. All this, of course, boils down to higher costs in Danish ships than in ships of some other flags, but that difference might be overcome by an old maritime nation's superior efficiency in all fields of shipping, from the job of an able-bodied seaman to that of the brain-trust behind a major shipping concern.

However, the situation briefly outlined here is to a growing extent being made use of by the obnoxious means of what is known as "flags of convenience". This occurs when a thrifty, though maybe not too scrupulous shipowner, to save expenses, has his ship registered in a country which has not signed any international convention on safety, social conditions and the like; which has, furthermore, little or no taxation of shipping profits; and, finally, which has no trade unions to enforce a decent standard of hours, manning, and pay. If the said shipowner is an able and clever man (which some of them are), and if he can secure a crew of real sailors, brought together from many seafaring countries (which sometimes he can), then it is evident that he is in a position to offer a murderous competition to fair and loyal shipowners of all countries. Several million tons of shipping to-day are sailing under "flags of convenience", and no means has been deviced so far to effectively stamp out this nuisance, though shipowners and the International Transport Workers' Federation alike are doing their best to fight it with all legal means.

This, however, is not the worst obstacle to free shipping. Far worse is the steadily growing tendency to employ open or clandestine subsidies or one or more forms of flag discrimination to hamper free competition in shipping. The object behind these practises generally is, for national or even military reasons, to build up or to maintain a higher tonnage under the flag in question than would be possible under free competition. Open subsidies, of course, speak for themselves: They are the prize being paid by the taxpayers of the country in question for the luxury of having a merchant navy under the national flag, resulting in higher costs of exports, higher prices for imports, and, consequently, lesser terms of trade, and a lower standard of living. The same may be said of differential treatment of foreign flag vessels in respect of despatch, harbour and customs dues, towing, lighterage etc.

More harmful than any other is the sort of flag discrimination best known as the 50 per cent. rule (i. e., that atleast 50 per cent. of all cargoes or of specified sorts of cargoes must be carried by vessels flying the flag of the country in question). This rule is included in several US laws, especially regarding government sponsored exports from the States, and in several trade agreements between the USA and some other countries. Unhappily, the system is being copied by a number of countries, especially in South America. It is quite evident that it means higher costs of transport (and, therefore, fewer transports otherwise advantageous to the nations in question) and, ultimately, a state of world shipping where subsidized vessels are carrying cargoes one way only and returning home in ballast. This, of course, is a short-cut to the ideal mentioned above (ten cargoes, nine ships) — but at what a cost!

Incidentally, the stipulation made by a great many countries that foreign flag vessels may not participate in coasting, is in essence of the same character, but is less harmful because most coasters are not built or equipped to go too far afield in search of a livelihood. Still, it is worth while to keep an eye upon tendencies to extend the meaning of the word "coasting" beyond reasonable limits. In law, a vessel performing a voyage from Portland, Oregon, to Portland, Maine, by way of the Panama Canal is employed in cabotage or coasting. All voyages between Hawaii and any U. S. port is

regarded as coasting, too, and, therefore, 100 per cent. reserved for American flag vessels ! It would indeed be a good thing if legislators in Washington would take a look at what their opposite numbers in Ottawa, Canada, are doing. Though Canadian shipowners are no more able than American owners to compete in a free market, still their government realizes the necessity of maintaining the freedom of the sea and the wisdom of having all transports performed by the cheapest and most efficient transporter.

The latest news from the cabotage front is truly surprising. It is a move from the Indian Government to have all seaborne trade between Ports of India and Ports of Pakistan regarded as coasting, i. e. reserved for vessels flying the Indian or the Pakistani flag. This would appear to be overdoing even a bad principle.

How very strong old maritime nations feel about all unnecessary restrictions to the freedom of world trade and shipping was shown when, within recent months, the governments of Norway and Denmark declined offers from the United States for the shipment of coal and other commodities against payment in their national currency and delivery of goods to third countries, for the very reason that the United States offer was made subject to the condition that at least 50 per cent. of the shipments made from the United States had to be carried by United States vessels. It is earnestly hoped that other maritime countries will follow suit.

It is an old proverb that charity begins at home, and if Denmark is so strongly against any form of subsidizing or flag discrimination it might well be asked, how is the attitude of Denmark herself towards these matters ?

The answer is that Danish shipowners have never, openly or covertly, received any financial aid from official quarters but have on two occasions in recent years had to pay heavy extra taxes over and above their being taxed exactly after the same rules as all other business concerns of the country; that the whole reconstruction of the Danish merchant fleet after the war has been accomplished without any Government grant or preference being asked for or given; and that only 4.5 million tons of Denmark's entire seaborne foreign trade of 15.3 million tons in 1954 were carried by Danish vessels. The Danish sector of this trade has fallen from 38 per cent. in 1938 to 36 per cent. in 1954. By way of comparison it may be mentioned that in 1954 no less than 29 per cent. of these transports were performed by German, 11 per cent. by Swedish, 10 per cent. by Norwegian, 8 per cent. by British and 7 per cent. by Netherlands flag vessels.

At the outbreak of World War II the privately owned Danish merchant fleet of vessels of 100 gross registered tons and over numbered 558 vessels totalling 1,099,000 g. r. t. Since the war the reconstruction has been marked by the following figures :

January, 1946 :	390 vessels aggregating		728.000	g. r. t.
January, 1950 :	541	,, ,,	1.137.000	,,
January, 1953 :	556	,, ,,	1.364.000	,,
April, 1954 :	570	,, ,,	1.495.000	,,
June, 1955 :	554	,, ,,	1.570.000	,,

To-day, ten years after the end of the war, the number of ships is practically the same as in 1939, but the tonnage is about 45 per cent. greater. This is explained, above all, by the structural change which has taken place in the composition of the fleet. Between the wars, more than one-half of all Danish merchant shipping was run as tramps, while to-day this applies to only some 25 per cent. This decline has particularly hit the smaller types of tramps carrying abt. 2,000 tons d. w. and preferably engaged in the North Sea and Baltic trades. The freight level and the political trade barriers in the area only partly account for the gradual disappearance of the traditional Danish tramp. The main reason is to be found in the heavy demands from Danish authorities and trade unions referred to above which result in a level of running costs almost prohibitive in the case of ships measuring between 500 and a couple of thousand tons gross. On the other hand, a new type of motor coaster measuring just under 500 g. r. t. and carrying some 925 tons d. w. has in later years been attracting the attention of several Danish shipowners who have found these little ships very handy not only in the near trades but also for voyages to small ports of distant countries like Greenland, Indonesia, and the Flakland Islands.

In stead of the sturdy, little tramp steamer of former days Danish shipping companies have turned to liner services and big oil tankers. A number of new regular services have been put into operation, i. e. from Scandinavia and the Continent to Indonesia, from Denmark to the Canary Islands, and from the Continent to Belgian Congo and French Equatorial Africa. The leading Danish liner companies are the following:

The East Asiatic Company Ltd. Regular sailings from Europe to Ceylon, India, Pakistan, Burma, Malaya, Indonesia, Thailand (Siam), Indo-China, the Philippines, China, Japan, Australia, New Zealand, New York, the West Indies, Central America and the Pacific coast of North America.

The United Steamship Company, Ltd. (Det Forenede Dampskibs-Selskab). Regular sailings from Scandinavian and Continental ports to the east coast of North America and South America, the Canary Islands, Western and Eastern Mediterranean, and from Denmark to Great Britain, Portugal, France, Belgium, the Netherlands, Norway, Sweden, Poland, Finland, Iceland, the Faroe Islands, and Germany.

Messrs. A. P. Moller (Maersk Line). Regular services between U. S. Atlantic and Pacific coast ports and Manila, Iloilo, Cebu, Japan, Keelung, Hongkong, Saigon, Bangkok, and Singapore, between Japan and India, Pakistan, and the Persian Gulf, and between Japan and Indonesia.

Messrs. J. Lauritzen (West Coast Line). Regular services between New York, Philadelphia, Baltimore, Gulf ports, and ports in Colombia, Peru, Equador, and Chile. Also seasonal reefer services to and from Brazil, the Argentine, Chile, etc.

The "Torm" steamship Company, Ltd. (Torm Lines). Regular sailings from New York, Philadelphia, and Baltimore to Brazil, Uruguay, and the Argentine; also to the Mediterranean.

Dansk-Fransk Steamship Company, Ltd. (Dafra Line). Regular service from Continental ports, in particular Antwerp, with direct sailings to Belgian Congo, and another service calling at French Equatorial Africa, Congo, and Angola.

It will appear that Danish liner shipping is well represented on the seven seas; and the Danish services have gained a world-wide reputation for careful handling of goods entrusted to them.

The Danish tanker fleet has also shown a remarkable increase during the post-war period. It now consists of 62 vessels aggregating 505,000 g. r. t. as against 100,000 tons in 1939. The heavy increase in world consumption of oil products and the necessity of bringing a growing proportion of crude oil from distant countries has urged owners to invest in tankers. The tendency to-day in Denmark as in most other shipping countries is to build ever larger units, the running costs of vessels carrying 8,000, 16,000, and 24,000 tons, respectively, being far from proportional. On the other hand it is felt in some quarters that the many new oil refineries in the United Kingdom and on the Continent will tend to decrease the number of long voyages from the production countries to consumer countries and thus make it a paying proposition to carry oil and petrol from European refineries in vessels able to enter any decent port in consumer countries. Only four Danish ports (viz., Copenhagen, Aarhus, Fredericia, and Nyborg) have sufficient water to receive really large oil tankers.

Be this as it may, it is a fact that the major part of tonnage now on order for Danish account is oil tankers. Several dry-cargo tramp owners are adding tankers to their fleets, and this, of course, is part of the reason why the Danish tramp fleet has decreased since 1939. Other reasons are mentioned earlier in this review.

Unlike many other shipping nations Denmark cannot base her shipping industry on her own imports and exports, or on the carriage of goods to or from her colonies. Only by keeping abreast of, or indeed leading, technical development and by frequent replacement of ships can Denmark expect to maintain her place as a shipping nation of importance to the international market. During the post-war years Danish owners have laid more stress upon modernization than upon fleet expansion, and about 68 per cent. of the present tonnage has been built since 1945. A considerable number of older ships have been sold in recent years, just as all but two of the war-time standard-ships bought from U. S. A. in 1947—48 have been resold. It is significant, too, that all new ships received in the last two years have been motor vessels.

Since 1912 when the world's first ocean-going diesel-engined vessel, the SELANDIA, was built by Burmeister & Wain, of Copenhagen, for the East Asiatic Company, Ltd., of Copenhagen, Danish owners have increasingly gone in for motor vessels. To-day this type of propulsion is used by 84.6 per cent. of the total Danish flag tonnage. Several of the vessels recently delivered are propelled by the new Burmeister & Wain two-stroke engine with turbo-charge. This new type of engine has fully met such expectations as better utilization of fuel, and savings of space and weight.

Recent statistics, made up by Danish Shipowners' Association, reveal, i.e., the following interesting facts as per January 1st, 1955:

Coal-burning steamers under the Danish flag numbered 52 (9.5 per cent. of the total number) and measured 79,000 g.r.t. (5.2 per cent.). Their average age per ship was 35.4 years and per g.r.t. 33.1 years.

Oil-burning steamers numbered 59 (10.7 per cent.) and measured 153,000 g.r.t. (10.2 per cent.), their average age being 16 and 15.1 years, respectively.

Dry cargo motor vessels and auxiliary vessels numbered 383 (69.5 per cent) and measured 834,000 g.r.t.

(55.5 per cent.), and their average age was 19.7 years per vessel and 10.6 years per g.r.t.

Oil tankers (all diesel propelled) numbered 57 (10.3 per cent.) and measured 437,000 g.r.t. (29.1 per cent.), their average age being 8.5 and 6.3 years, respectively.

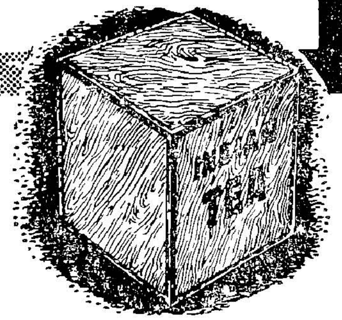
Incidentally, this brings the average age of the whole Danish merchant fleet to 19.7 years per vessel and 11 years per g.r.t., the proportion of tonnage less than ten years or more than twenty years old being 66.7 and 18.6 per cent., respectively. The access of new vessels during 1954 was 30 ships aggregating 145,798 g.r.t. (216,630 tons d. w.) as against 31 vessels of 141,767 g.r.t. (200,005 tons d. w.) in 1953. In the same period 46 vessels of 103,010 g.r.t. (159,973 tons d. w.) were sold abroad, the comparable figures for 1953 being 22 vessels of 59,680 g.r.t. (87,513 tons d. w.)

The importance to the Danish shipping industry of sailings between foreign ports has been stressed more than once. As a matter of fact, the steadily increasing amount of freight earnings in foreign currency has been of paramount importance to the national economy of Denmark in recent years. Only 16.2 per cent. of total earnings in 1954 were due to sailings to or from Danish ports, while 83.8 per cent. were earned by service to other nations, the latter figure comparing with 70 to 75 per cent. before the war.

Gross earnings in 1954 are estimated at 1,070 million kroner (55 million Latr.) apart from passenger money. This total may be split up in kr. 260 mn. in Dollars, kr. 360 mn. in Sterlings, kr. 265 mn. in other foreign currencies, and kr. 185 mn. in the national currency. From these figures expenses in foreign currency must be deducted. Broadly speaking, this deduction will be between 50 and 55 per cent. of the total amount.

The net proceeds are a heavy component in Denmark's "in visible exports" which are absolutely necessary in balancing the country's foreign payments, because year after year, the trade balance shows a deficit. It is, therefore, the earnest hope of the whole Danish community that the good services of Danish sailors and ships will be as readily accepted by shippers and charterers of other nations, as the produce of Danish agriculture, industry, and handicraft are welcomed by consumers in practically all countries.

India's Tea- India's Wealth



ALLIED INDUSTRIES :

The Indian Tea Industry assists other industries like plywood, ceramics, coal, cement, fertiliser, tea machinery and transport.

TEA BOARD INDIA

No other drink refreshes you so much, yet costs so little as TEA

PST 150

Special Diesel Locos for Indian Railways

BEFORE the end of this year the last of 20 Diesel-hydraulic locomotives specially built for India's Western Railway will leave Glasgow, where they were built by the North British Locomotive Company. Thirteen of them are already in service in India.

These Diesel locomotives were specially ordered because of the shortage of coal and the quality of water on the 170-mile rail line from Deesa to the new port of Kandla. They have a top speed of 55 mph. To run on metre gauge they are normally capable of producing 625 bhp, but have been de-rated to 605 bhp to suit the atmosphere of high humidity in which they must operate.

North British is but one of several companies engaged in work for India, Pakistan, and Ceylon. The Pressed Steel Company, of Cowley (Oxford), begins delivery early next year of more than 2,000 railway wagons; and Hurst, Nelson & Company, of Motherwell (Scotland), has an order for other rolling stock for Indian Railways. At the same time, R. Y. Pickering & Company, of Wishaw (Scotland), is supplying more than 1,000 covered railway wagons for Pakistani railways.

* * *

SUSPENSION BRIDGE WITH WORLD'S LONGEST MAIN SPAN PLANNED

Plans for a bridge with a main span 300 ft. longer than that of San Francisco's Golden Gate—the longest suspension bridge in the world to-day—are being considered by the corporation of Hull, Yorkshire. The projected bridge will cross the River Humber just below Hull, and would be capable of carrying the heaviest traffic permitted on the roads of Britain.

One of the chief purposes of the bridge would be to reduce the length of road journeys between places north and south of the river. It is estimated that the saving in transport cost would be over £ 1,000,000 a year. Full use of the results of a comprehensive series of tests on the ærodynamic stability of long suspension bridges in both Britain and the United States has been made in its design. Cost of the bridge and approaches is estimated at £ 13,000,000 and construction time at about five years.

* * *

SMITHFIELD SHOW DEMONSTRATES GROWING MECHANISATION TREND

The Smithfield Show, which has just concluded at Earls Court, London, demonstrated in graphically concrete terms the growing momentum of the trend towards greater mechanization in agriculture throughout the world—even in the remoter parts of it. The show had many new things to offer, and one or two that could fairly be described as revolutionary. Among the latter was a highly unconventional tractor with a rear-mounted, air-cooled Diesel engine and many other innovations of design, introduced by a Yorkshire firm.

Other products on view included rubber wash-troughs; the prototype model of a light, hard-wearing, waterproof, rotproof glass-fibre tipping truck; a potato harvester for work on the more difficult soils, which incorporates a new system for separating clods and stones; a front-mounted winch with which a driver can get his tractor out of snow or deep mud when it gets bogged down; and a machine for "dry-cleaning" eggs at the rate of 20 dozen an hour.

* * *

NEW SPECTACLES AID THE DEAF

Spectacles with built-in hearing-aids will be shown by a London firm for the first time at the Olympia (London) section of the British Industries Fair (April 23 to May 4, 1956). Powered by tiny batteries, they have been developed as a result of recent advances in the making of miniature electronic components.

Many styles will be available to suit wearers in different regions—metal frames for people in the United States, heavy dark tortoise-shell frames in Mediterranean and South American lands, and so on. The "Spectaphone"— which uses a transistor—marks 30 years of in progress the firm's search for an efficient, unobtrusive hearing-aid.

[The first part of the 1956 B.I F. will be held at Earls Court, London, from February 22 to March 2. The second part (April 23 to May 4) will be held simultaneously at Olympia (London) and Castle Bromwich (Birmingham).]

* * *

HYDRAULIC RE-RAILING EQUIPMENT

Appliances operated by a pneumatic hydraulic transformer

FOR many years Maschinenfabrik Deutschland G.m.b.H., Dortmund, has specialised in the design and manufacture of locomotive and rolling stock re-railing equipment. After exhaustive trials witn the firm's pneumatic-hydraulic re-railing devices known as the Deutschland type, the equipment has been standardised on the German Federal and other European railways. The Eastern Region, British Railways, has also carried out extensive trials with this equipment which now forms part of the breakdown plant of that Region.

POWER EQUIPMENT

The types of power units vary, but in all cases the lifting jacks are operated either by compressed air or hydraulic power. On the German Federal Railway the hydraulic lifting jacks are operated at a minimum pressure of 300 kg./c. m. 2, the plunger pump being driven by compressed air. The pump check valves and liquid container are mounted to an aggregate and form a self-contained unit. Where the equipment is required to operate with trains equipped with vacuum brake, the pneumatic-hydraulic transformer pump is replaced by a hydraulic pump driven by a 4-5 h. p. diesel engine.

The hydraulic unit is driven by a vee-belt and friction clutch, so that the diesel engine can operate at full speed without the hydraulic unit coming into action. The pressure liquid is a thin acid-free oil, which is by-passed by means of a cut-off pump. The diesel engine set is mounted together with the pressure pump on a light frame travelling on rubber tyred wheels. Hand-operated hydraulic pumps also are available.

Various telescopic jacks are available, which are designed to give a high lift in relation to their normal height, typical capacities of which are as follow :—

Lifting capacity, tons	150/75	120/60	60/30	40/20
Normal height, in.	17.5	17.5	20	20.1
Height of lift, in.	19.4	19.4	25.8	27

The lifting jacks operate with equal efficiency when using either the pressure-liquid or pneumatic-hydraulic pump. Other types of jacks are included in the equipment which include claw jacks, of 40 tons capacity, with a lift of 30.5 in., the claw is positioned at the bottom, which enables the jack to operate at a very low point. For lifting wagons a claw jack of 16 tons capacity is available. In this design, the lift is 30.5 in., three of this type are used in conjunction with heavy or light pin chains for raising overturned vehicles.

TIPPING JACKS

For re-railing vehicles which are derailed at one axle a special tipping jack is available with a capacity of 16 tons and of light-weight construction. A device is used to fasten the head of the jack to the buffer, and a claw on the jack provides a low lift of 2.5 in. above ground. An axle inserter serves a small jack of 10 tons capacity, which as a thrusting cylinder, is used for pushing derailed locomotives laterally after lifting.

With the exception of this jack and the special tipping jack, all are fitted with automatic non-return valves, to prevent dropping of the raised vehicle in the event of the high-pressure hose bursting. All high-pressure hose is made of Tombac, and is very flexible. It is supplied in lengths of 16.4 and 32.8 in.

LATERAL MOVEMENTS

Re-railing bridges are used for the lateral movement of locomotives. These are 6.7 and 13.1 in. long, and are composed of double rails with spacing blocks between, and a built-in hydraulic pulling cylinder. For small lateral movement a roller grid is included in the equipment which moves over a substantial steel plate with wooden base, placed between the track.

Besides what may be termed or standard equipment, the firm has developed other types of plant including a hydraulic hauling device which has a tractive power of 30 tons, and used in conjunction with wire rope and pin chain.

HYDRAULIC PISTON

The stroke of the hydraulic piston corresponds to the length of the chain links, 31.5 in. At the end of the

stroke an auxiliary lever is used to lock the load which is firmly held in position while the piston is returned from its advanced position.

After the removal of a chain link a further pull of 31.5 in. can be carried out, a feature which produces what is in effect an endless pull. It is claimed that this method is so closely controlled that no damage can accrue. This equipment is recommended for use for re-railing operations resulting from severe accidents. The link chain system is also used for raising overturned locomotives.

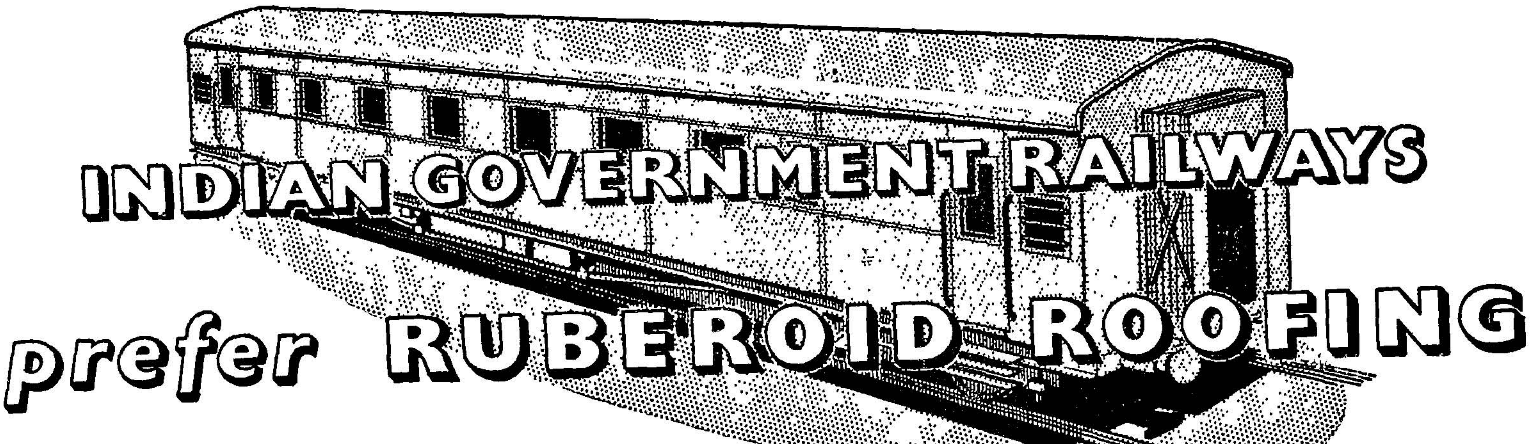
Auxiliary bogies have been designed for the hauling of derailed bogie vehicles. The bogie has a capacity of 20 tons, and can be loaded into the breakdown van in a dismantled condition. The bogie has a swivel bolster which enables a damaged vehicle to negotiate curves and varying heights is compensated for by a screw jack. For the unloading of equipment carried in breakdown vans a compressed air, slewing jib crane has been developed capable of lifting $5\frac{1}{4}$ cwt. The crane is carried on a runway suspended from the roof of the van. The jib extends beyond the buffers at each end.

SECOND BRITISH ORDER

After successful experiments British Railways have ordered three more sets of re-railing equipment from Maschinenfabrik Deutschland similar to that supplied to the Eastern Region, which includes heavy and light hydraulic jacks, self-contained mobile diesel-hydraulic pump unit, and crank and chain apparatus. The tests included re-railing of locomotives, carriages and wagons without the use of cranes.

This equipment is to be allocated to motive power depots at Gorton, Mexborough, and Darnell, where the use of breakdown cranes with jibs of normal height would present some difficulty because of the overhead wires for the Manchester—Sheffield—Wath electric services. (Reprinted from "The Railway Gazette," October 30, 1953)

For its remarkable DURABILITY
under all climatic conditions



In rolls of 72 feet—36 inches or 50 inches wide

Agent :

PARRY & CO., LTD., DARE HOUSE, MADRAS-1.

CONCRETE ON THE RAILWAYS

TRADITION ON THE RAILWAYS

FOR many years past the use of cement concrete, both plain and reinforced, has been steadily increasing on Indian Railways. A hundred years ago, when the first railway was built in India, lime concrete and wrought iron were the materials chiefly used for railway structures, and many of these structures still stand—monuments to the careful designing and excellent workmanship of the early railway engineers. These structures have not only stood the test of time, but have also been carrying, in many instances, much heavier loads than they were originally designed to carry—proof of the remarkable conservativeness in the codes of railway engineering practice. This "play-for-safety" attitude continues to this day on our railways and can be seen even in some very recently built bridge structures. The explanation of so much conservatism lies partly in the vigorous and fluctuating conditions of loading to which railway structures are subjected and partly in the fact that railway engineers have to guard against failures which may result not only in damage to public property but also in the loss of a great many lives.

In recent years, however, our knowledge of the behaviour of structures under load has been much advanced by scientific investigations and research, and with the modern materials now available for structural works, a stage has been reached when considerations of economy must be balanced against those necessary to ensure safety.

CONCRETE REPLACES STEEL

In the past, when the tempo of construction was slow, steel was available or could be imported in time for new works. Again, for frames of minor structures and for posts, trusses and purlins of the thousands of sheds which the railways need for a variety of purposes, second-hand rails were always ready at hand. This sufficiency in new steel and old rails is no more with us. We cannot afford to import; our own output of steel is unable to meet the full demands even of works of first rate importance and the indiscriminate use of rails for structural work would, under the present circumstances, be a waste of national assets. Worn rails can be re-rolled into structural sections or into rounds for reinforcement and then put to far more economical use in structures.

CONCRETE PRODUCTS

With steel so difficult to obtain, it is cement concrete that has helped the railways to cope with the heavy post-war rehabilitation schemes. Concrete has been used extensively in the make-up of station and way-side signboards and name-boards and even in signal posts and gantries. Small public amenity structures like water huts, tea stalls, benches etc., have been rapidly erected to type designs on many station platforms, using concrete components precast under controlled conditions in central casting depots. The rapid fencing in, of the many railway storeyards and workshops that have been established after the war has been carried out with the help of precast grooved pillar and sliding panel units.

CONCRETE MASONRY AND PRECAST CONCRETE

Large-scale manufacture of hollow concrete blocks has made possible the construction of railway colonies at speeds of a bungalow or a staff-quarter per day. With experience gained in hollow block masonry construction on large projects such as the Chittaranjan Loco Works, the Assam Rail Link and Kandla Deesa Projects, initial defects have been overcome and concrete masonry is now being extensively used on all the railways, particularly in cities, where the cost of burnt bricks is high and in the many areas in the interior where good bricks and building stone are not available. The development of gunite and precast concrete work on the Western Railway and of composite precast and in-situ concrete work on the Central Railway have enabled these and other railways adopting the practice, to build far more "low-cost" staff quarter in the last few years than would have been possible in brick or stone masonry.

CONCRETE IN BRIDGE CONSTRUCTION

In almost all important railway bridges also, the massive masonry of piers, abutments, and protection walls has, in recent years, been built in cement concrete, economy and rapidity of construction being the main considerations leading to the choice of this material. In small span culverts, the "hard spots" in running caused by "rail clusters" and steel girders are being progressively removed by the use of precast reinforced concrete slabs with a ballast cushion between the track and the slab. For larger spans, cement concrete arch and rigid frame designs have proved more economical and are being increasingly used in place of stone masonry arches and steel girders. In still larger spans, fabricated steelwork is being rivalled in economy and durability by concrete girders, designed and constructed according to the new practice of prestressing concrete. Girders of 40 feet and 60 feet spans in prestressed concrete have been installed and are giving excellent service on the Assam Rail Link and the Western Railway. Tests to destruction of prestressed girders carried out in India in 1952 have yielded encouraging

results. The advancement in design in foreign countries continues; larger and larger spans are being built and a prestressed railway bridge with a 160 feet span has recently been opened to traffic in England. With such advances in design and our own experience in construction, the popularity of prestressed concrete girders is bound to increase in our country, particularly as their installation on large bridges will do away with the tedious duties of periodical rust and rivet inspection and save the cost of the now continuously employed painting gangs.

CONCRETE SLEEPERS

In the construction and maintenance of track, cement concrete is being increasingly called upon to play it part. The pre-war designs of concrete sleepers were heavy and liable to crack under the impact of heavy traffic. Improved methods have now made it possible to have sleepers in much lighter sections and the elimination of tension in the concrete, even under the heaviest loads, by prestressing during manufacture, has removed entirely the danger of cracking and consequent deterioration. Experimental lengths of Dowmac and Stent patent prestressed sleepers have been laid on the Central Railway and are giving good results. As the difficulty in obtaining good salwood and softwood sleepers continues to increase, the use of prestressed concrete sleepers by Indian Railways is likely to be taken up on a large scale, particularly if an Indian firm succeeds in manufacturing them in India at competitive costs.

SOIL STABILIZATION

Soil stabilization by pressure grouting of concrete has been very popular on American railroads for many years now and has resulted in greatly reduced maintenance and remarkable improvement in running conditions. This method has been employed to some extent on our railways also, particularly on the Central Railway. All our lines, however, have many lengths which (due to an unstable fill or a weak subgrade) are costly and difficult to maintain and which often need permanent speed restrictions to ensure safety. In many such cases, pressure grouting of concrete would be an effective and economical solution and it is felt that as our cement production increases and restrictions on supply are lifted, our Railways will budget for bigger programmes of stabilization of "soft spots" by pressure grouting concrete under main line tracks.

CONCRETE MARCHES ON

Meanwhile, research in this country and in Europe and America is showing the way to the solution of many problems. The many lessons learnt from field investigations have led to improved design details and better construction methods which must benefit the railways to a tremendous extent. Concrete used on the railways, more than elsewhere, is often exposed to extreme and unusual weather conditions such as the dry heat and the large variation of daily temperatures in most Indian deserts or the torrential downpours and persistent damp in the coastal monsoon areas. Fast-flowing rivers abrade bridge piers and the alternate wetting and drying by salt waters in tidal creeks eat them away. The smoke and fumes from locomotives attack chemically the underside of bridges crossing the track and the walls, pillars and roofs of running sheds and workshops. Investigations directed to making concrete weather-resistant will produce the answers that will help railway engineers to select materials and designs to suit these varying conditions.

Much progress has been made in the knowledge of cement and concrete since research work began in England and America some 30 years ago. In our own country, railways have carried out investigations in concrete and in the application of its results. Experiments on the water-cement ratiostrength relationship were carried out as early as 1934 by the Bombay Baroda and Central India Railway (now the Western Railway). In recent years the inter-relationship between the size, grading and other characteristics of aggregates and the workability and economy of concrete mixes have been investigated. Based on these investigations a method of rational proportioning of concrete has been evolved which has been employed by the Western, Central and other railways to obtain concretes of known and requisite strengths.

Further investigations on the results of research carried out in other countries will, it is hoped, soon enable our railways to obtain soil-cement mixtures for surfacing their numerous platforms, for low-cost pavements in the railway colonies and for stabilizing slipping side slopes of earth banks. The investigations on the beneficial effects of air-entrainment in concrete which are now in an advanced stage are likely to prove important to the railways.

More economical designs in reinforced concrete are being carried out in Europe and America. Experiments on reinforced concrete structures and their components have revealed that the live-load carrying capacity of certain types of reinforced concrete structures is much greater than the capacity computed by standard design methods. It is believed that this capacity results from the plastic yielding of concrete. This is being investigated and when the plastic theory is verified experimentally, it will result in a better understanding of the behaviour of concrete structures. This will be of immense benefit to our railways whose yearly building programmes include a large percentage of reinforced concrete structures.

WARD STAYBOLT AND FUSIBLE PLUG LATHES

WHILST Messrs. H. W. Ward & Co. Ltd., Birmingham manufacture a wide range of standard Capstan and Turret Lathes for general use in locomotive workshops, they have also developed a number of special machines for the production of Firebox and Roofing Staybolts and Fusible and Washout Plugs.

The machine shown in Fig. 1 is a No. 7 Staybolt Turret Lathe specially designed and equipped for producing roof or crown staybolts from steel bar or forgings and it will handle staybolts up to 1.3/8″ diameter by 34″ long.

When required for making staybolts from bar, the machine is fitted with a hand or air operated bar chuck with a far feeding arrangement that will accommodate bars up to 12′ 0″ long. It is recommended that all bars, which can be black or bright drawn are reeled before they are used.

The undercut portion between the two threads machined with a special double throw roller steady running toolholder that has eccentrically operated slides for quickly setting the rollers and cutting tool. Before this toolholder is used another special roller toolholder produces an undercut wide enough to allow the rollers and tool of the turning toolholder to be set at the required reduced diameter.

The threads are cut simultaneously with two self opening dieheads. One is mounted on the turret face opposite to the cut away in the turret for the second diehead that is mounted on an extension barrel that can be set to cover varying lengths of staybolts, there is also a graduated dial for setting the two dieheads in pitch. To ensure that the dieheads cut accurate threads, the turret saddle has leader screw control. The lever that engages the nut with the leader screw can be seen on the left hand side of the turret, shown in Fig. 2.

When one end of the staybolt has a taper thread, a diehead with a taper threading attachment is used for producing the thread.

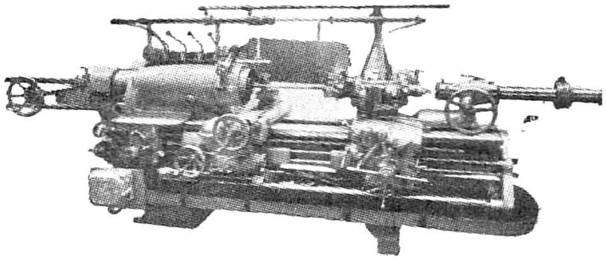


Fig. 1. No. 7 Staybolt Turret Lathe equipped for producing roof staybolts from bar.

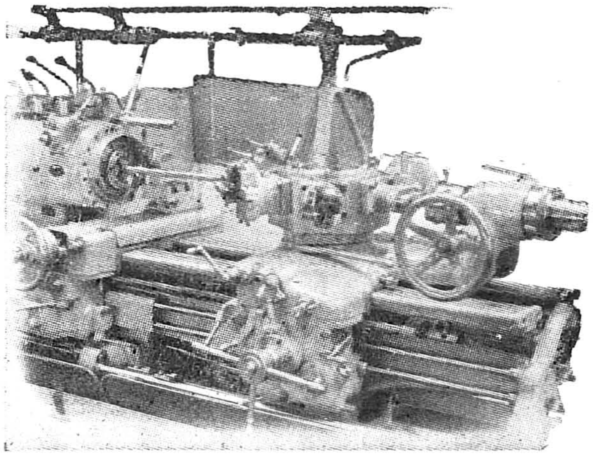


Fig. 2. View of Turret Toolholders and Duplex Diehead Bracket on No. 7 Staybolt Lathe.

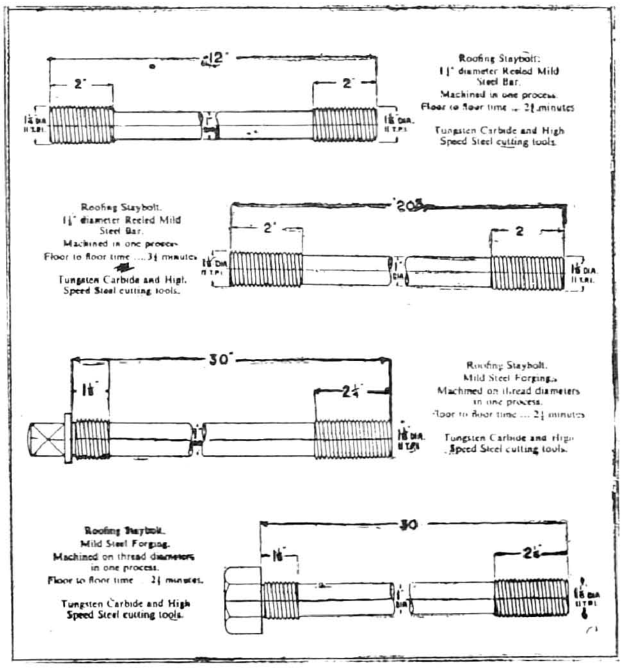


Fig. 3. Group of Roof Staybolts with production times.

Production times for four types of roofing staybolts are given in Fig. 3, these include staybolts made from bar and forgings. The times cover for the use of Tungsten Carbide tools for all turning operations and high speed steel cutters for the forming, screwing and parting of operations.

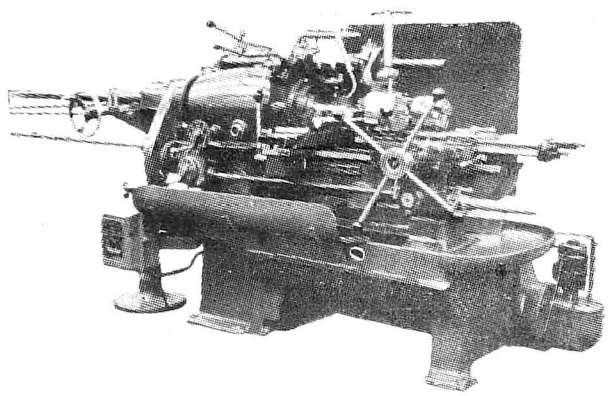


Fig. 4. No. 3A Staybolt Capstan Lathe with tooling equipment for machining Firebox Staybolts.

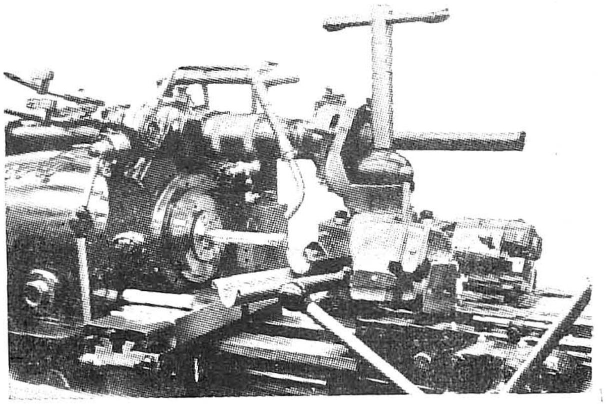


Fig. 5. View of air bar chuck with overhead leader screw and tooling equipment.

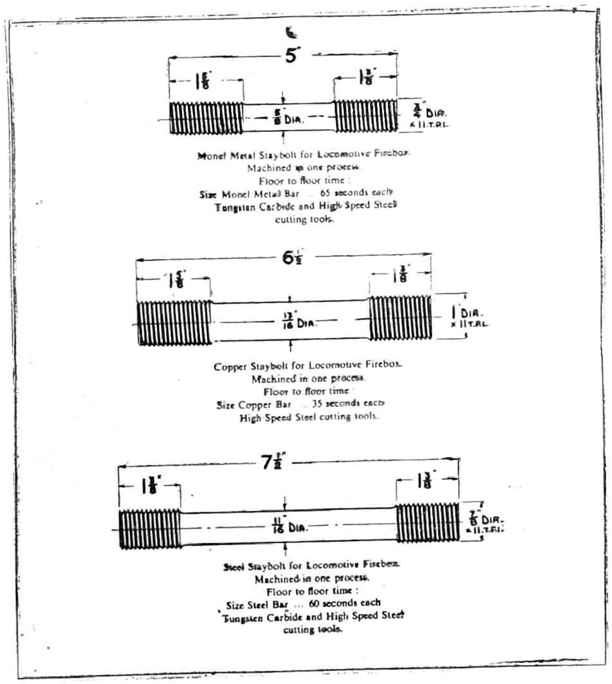


Fig. 6. Production times for Firebox Staybolts on No. 3A Staybolt Capstan Lathe.

The No. 3A Staybolt Capstan Lathe shown in Fig. 4 is equipped for manufacturing firebox staybolts. This lathe will deal with staybolts up to 1.3/8" diameter × 10.1/2" long when made from either copper, steel or monel mental bar.

The machine is fitted with an automatic bar chuck which can be of the hand or air operated type and the bar feed arrangement will handle bars up to 13′ 6″ long.

A special roller steady turning toolholder is used for turning the reduced diameter between the threads. This holder has a lever operated tool slide and carries rollers that are in advance of the cutting tool and steady on the outside diameter of the bar.

A close up view of the tooling equipment can be seen in Fig. 5 and on the turret face carrying the adjustable stop can also be seen a special cone that is used for spinning the end of the copper bar true before machining commences. Underneath this is a " catcher " for collecting the finished staybolt when it is parted off.

To ensure that the threads are in continuous pitch the self opening diehead is controlled by an overhead leader screw, the nut for engaging with this is carried in a bracket on the top of the hexagon turret. The leader screw cannot be seen in the photograph as it is covered by telescopic guards; it is conveniently driven by gearing from the lathe spindle. When different pitch staybolts have to be machined, the leader screw and nut can be quickly changed.

The lathe has a specially designed large capacity swarf pan and it is possible to remove all swarf from the rear of the machine without interferring with the Operator and affecting production.

Fig. 6 gives floor to floor times for three sizes of fire box staybolts when made from monel metal, copper and steel bar.

The machine shown in Fig. 7 is a No. 7 Capstan Lathe specially arranged and equipped for the production of fusible and washout plugs.

A hand or air operated two jaw chuck with vee shaped jaws is used for gripping the gun metals castings on the squared head.

All the machining operations are effected by toolholders mounted on the turret of the capstan slide and it will be noted from the photograph, Fig. 7 that the machine is not fitted with an intermediate saddle.

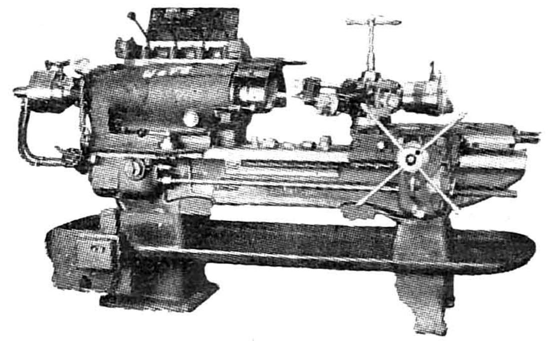


Fig. 7. No. 7 Fusible Plug Capstan Lathe fitted with air operated two jaw chuck.

When the machine is set up for producing fusible plugs, the first operation is to start drill and cone the end, this is followed by a combined drilling, ending and step turning operation. A special taper turning toolholder that can be clearly seen in Fig. 8 turns the taper thread diameter and also the small taper step at the front of the plug.

The undercut at the back of the thread is produced by an automatic recessing toolholder that has a cam actuated toolhoder whereby the cutting tool passes through an angle of approximately 90° to produce the required depth of undercut.

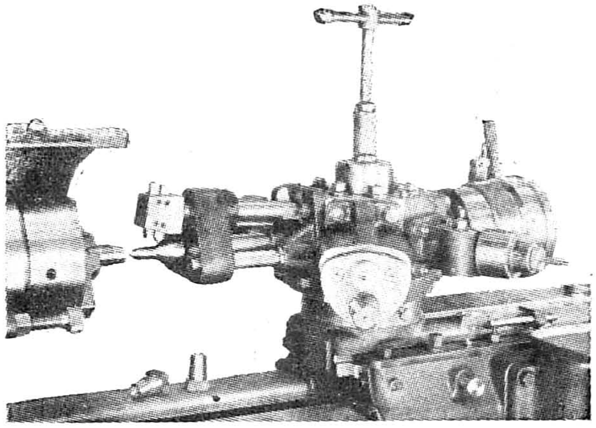


Fig. 8. View of some of the special toolholders for producing Fusible Plugs.

A ground thread tap held in a releasing tapholder is used for tapping the internal thread and this is mounted on the fifth turret face.

The last operation consists of cutting the taper thread and this is done in one cut with a 2″ self opening diehead that has a taper threading attachment. To enable this diehead to rotate over the top of the capstan slide, the machine has an increased height of centre.

The sequence of operations to produce taper washout plugs is similar to those above, but instead of the drilling, coning and tapping operations, the plug is only centre drilled. This centre hole forms the location and abutment face for the revolving centres in the taper turning and undercutting toolholders.

Floor to floor times for three sizes of plugs are given in Fig. 9 and include for using Tungsten Carbide tools for the turning operations.

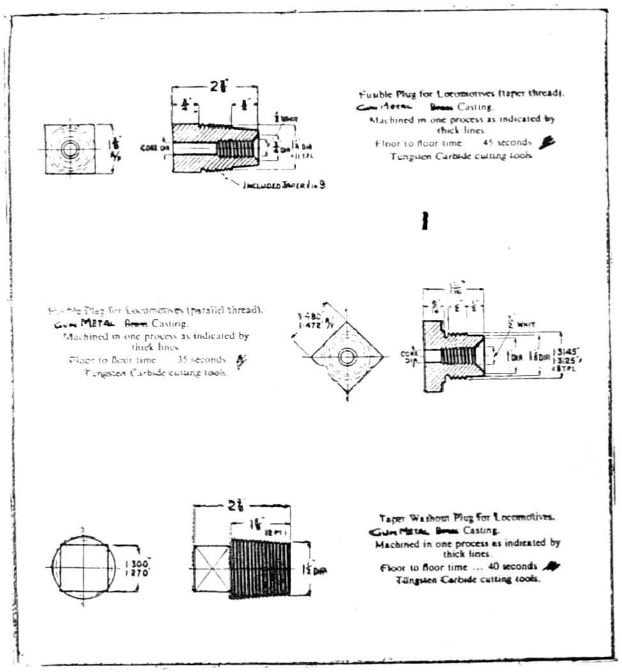


Fig. 9. Three types of Locomotive Plugs with machining times.

AUTOMATIC FLASH BUTT WELDING MACHINES

AUTOMATIC Flash Butt Welding is undoubtedly the procsss of "perfect Welding" in that the parts are truly forged in a manner comparable with the power hammer, of blacksmith's weld. The principle of this method is shown in Fig. 1. The two parts are clamped in the jaws or vices of the machine, which in turn are connected to the transformer, the one jaw being fixed and the other movable, mounted on a slide, through which the forging or upsetting pressure is applied.

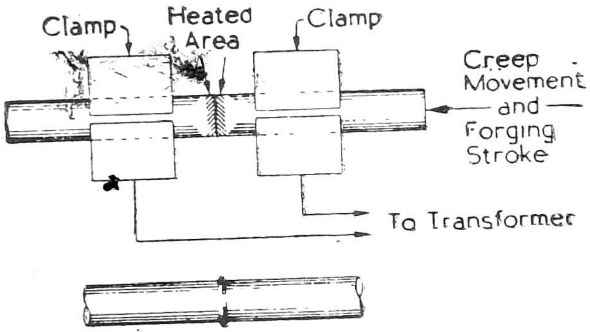


Fig. 1. The principle of Flash Butt Welding.

Simultaneously with the current application a very light pressure is applied to the moving jaw, causing an arc between the contact faces of the metal. The heat generated from this arc is so intense that it burns away the end faces uniformly on both sides, so that if the arc is maintained by a "creep" action of the moving jaw, a high temperature is rapidly obtained, the current is them switched off and the creep movement transformed instantly into a sharp blow, this action forging the plastic, or weldable metal and giving a homogeneous joint.

Automatically controlled machines operate on mass production lines and are capable of giving a high rate of output.

An automatic general-purpose flash-butt welder is shown on Figure No. 2. This machine uses compressed air at a pressure of 80 to 100 lb. per sq. in. and has a patented automatic control which can be set to give any desired welding conditions for the work in hand so that it is possible to pre-set the flash distance, upset distance, flashing time and upsetting pressure to suit any particular assembly within the capacity of the machine without the interchange of any parts in the control system, a simple adjustment of the indexing system being all that is necessary to give the correct welding conditions.

The machine is suitable for the high speed flash-butt welding of medium-light assemblies not only for quantity production but also for those conditions where a variety of assembly operations are required in the production programme.

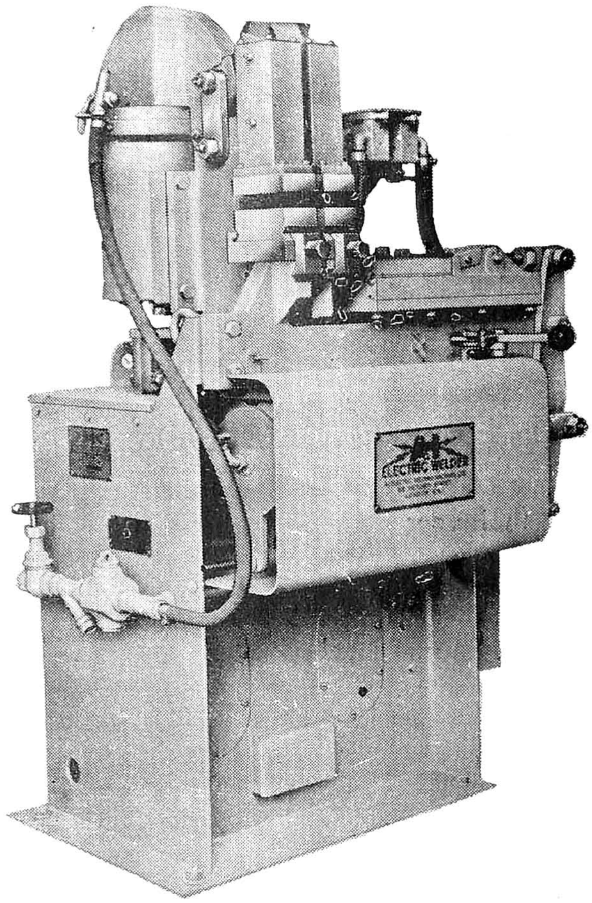


Fig. 2. A.F./1 Automatic Flash Butt Welder.

An example of an automatic flash-butt welder specially designed for the welding of light alloy cycle rims is illustrated on Fig. No. 3. In the past, the flash-butt welding of light alloys presented many problems, but these have now been successfully overcome and the machine shown has been designed to give high-class quality welding results coupled with a high rate of production. A patented system of control incorporating Ignitron Contactor Switchgear is fitted, as very accurate timing of the weld cycle is essential, the actual weld time being so short that it is measured in cycles.

Similar machines of this type have been supplied to handle other light alloy welding applications, such as the flash-butt welding of light alloy window frame

sections, etc. As the welding times are so short, the output depends almost entirely upon the rate of loading and unloading.

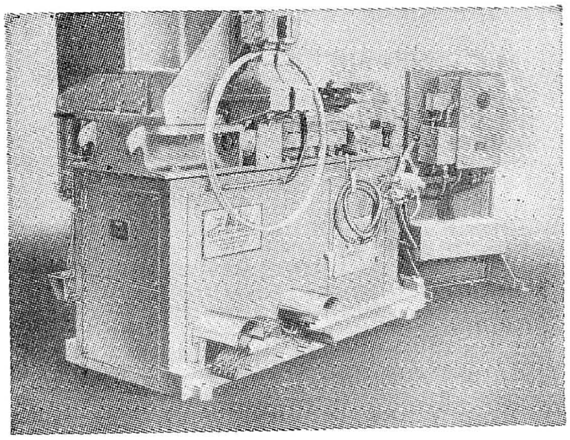


Fig. 3. A-I Automatic Flash-Butt Welder for Light Alloy Cycle Rims.

To meet the demands of industry for the increased production of automobile wheels, tractor rims and the like, the automatic flash-butt welder shown on Figure No. 4 has been developed. This machine is capable of giving an output of 750 KVA and is able to handle rims up to 14 in. wide by .187 in. thick, and from 14 in. to 36 in. diameter, and therefore should be of particular interest to all firms engaged in the manufacture of wheels and where basic costs of quantity production are a prime consideration. Air-oil intensification has be incorporated in the clamping and forging units, giving exceptionally rapid action in clamping and inclamping. A fully automatic cycle is given from the commencement of the clamping operation until the rim is ejected from the electrode dies at the termination of the weld cycle. The actual welding time is 2 seconds, whilst the automatic features involving the progressive clamping, welding, unclamping and ejection of the rim result, in a total floor to floor time of 6 seconds when welding average-sized rims.

Ignitron contactor equipment has been incorporated, thereby eleminating the problem of maintenance which is so serious on high-speed machanical contactor switchgear.

The welding of steel rails is becoming increasingly important. The system has long passed the experimental stage and there appears to be no doubt that the system will be increasingly used throughout the world. The advantages of greater safety combined with smoother running as well as less wear and tear upon the

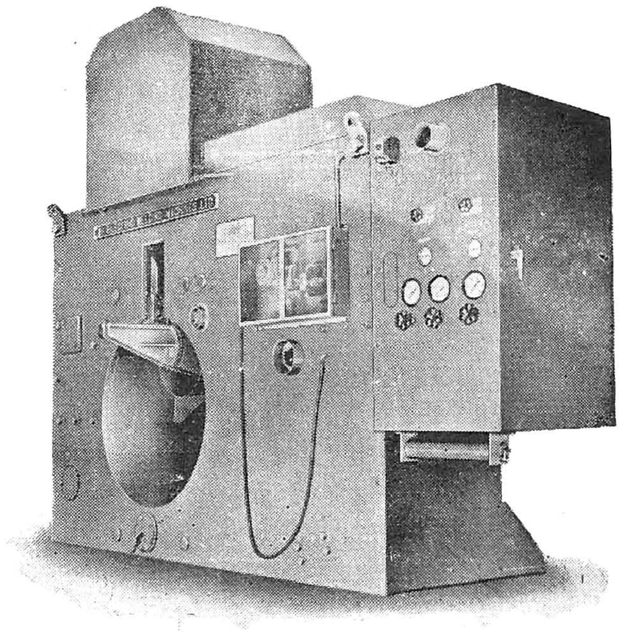


Fig. 4. 750 KVA High Speed Automatic Flash Butt Welder for Steel Rims.

rolling stock can only be achieved by having accurately aligned rails which are perfectly welded and afterwards normalised to ensure that the crystal structure and physical properties of the finished rails are consistent throughout their length, for we must never lose sight of the fact that every inch of rail is subjected to load and stress conditions, a state of affairs which is not usual with welded components.

The illustration given on Figure No. 5 shows an automatic rail welder capable of welding main line rail sections up to 131 lb. per yard. Such rail welding machines have been installed in many parts of the world. Horizontal and vertical adjustment is provided so that the rail surfaces are perfectly aligned even when under

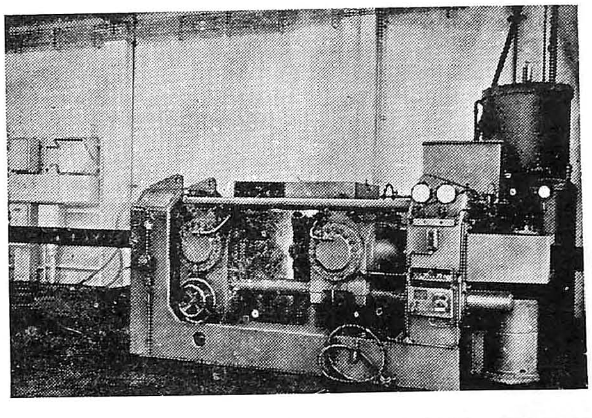


Fig. 5. A. I. Patent Automatic Rail Welder. (Machine in Operation at Netherlands State Railways Utrecht Depot)

full clamping pressure. Central loading gives equivalent distribution of the upset pressure over the entire rail section. The clamping arrangements for such large sections must necessarily be substantial and on these machines duel clamping is employed, a heavy horizontal clamp action being applied to the rail web whilst the current application is given by compensating clamps of the vertical type, requiring only the pressure necessary to maintain efficient current contact.

Automatic control governs the pre-heating, flashing and final forging of the rail sections, the special feature of this control system being that the pre-heating application is compensatory for the contact surface conditions of the rails, a factor of importance in rail welding technique.

"A. I." Post Heating Equipment for normalising the flash-welded rail joints is built in two models, stationary and portable. The rails are normally fed from the Rail Welding Machine into the Post Heater where the rail joint is automatically normalised by raising the temperature to 850° c., the temperature being automatically controlled by means of an optical pyrometer unit.

The clamp equipment is of the air-oil intensifier type which secures high efficiency in current contact conditions.

Another extremely interesting automatic Flash-Butt Welder is the machine shown on Figure No. 6 which is specially designed for re-ending the tubes from locomotive boilers. As is well known when tubes are

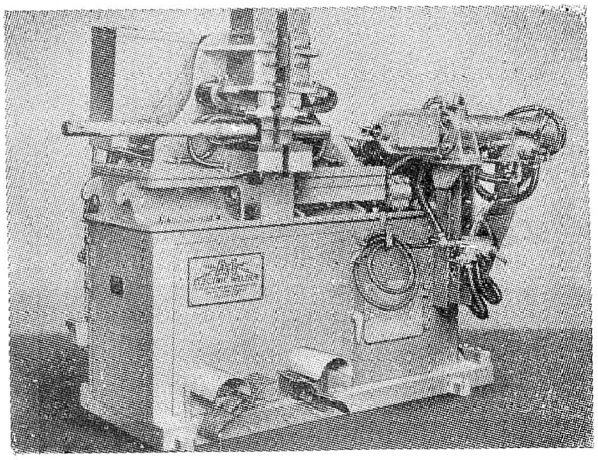


Fig. 6. A-I Automatic Flash-Butt Welder With Tube Stripper.

withdrawn from a locomotive boiler the ends are not suitable for further service. These re-ending machines enable the old ends to be removed and new ends to be flash-butt welded in a matter of seconds. The clamping and upsetting machanism is air-operated whilst a stripper unit is provided to remove the inside weld extrusion from the tube. The welder is rated at 100 k VA and is suitable for tubes up to $2\frac{1}{4}$ in. diameter.

A larger model of similar general construction is manufactured for superheated flue tubes up to $5\frac{1}{2}$ in. diameter.

The various patented Automatic Flash-butt Welding Machines described in this article are manufactured by A. I. Electric Welding Machines Ltd., London.

STANDARDISED HINDI AT RAILWAY STATIONS—WORDS FROM OTHER LANGUAGES RETAINED

The Railway Board has sent to all the Railways a list of standardised Hindi equivalents of terms and expressions used on signboards, with instructions that these may in future be used on station premises throughout the country.

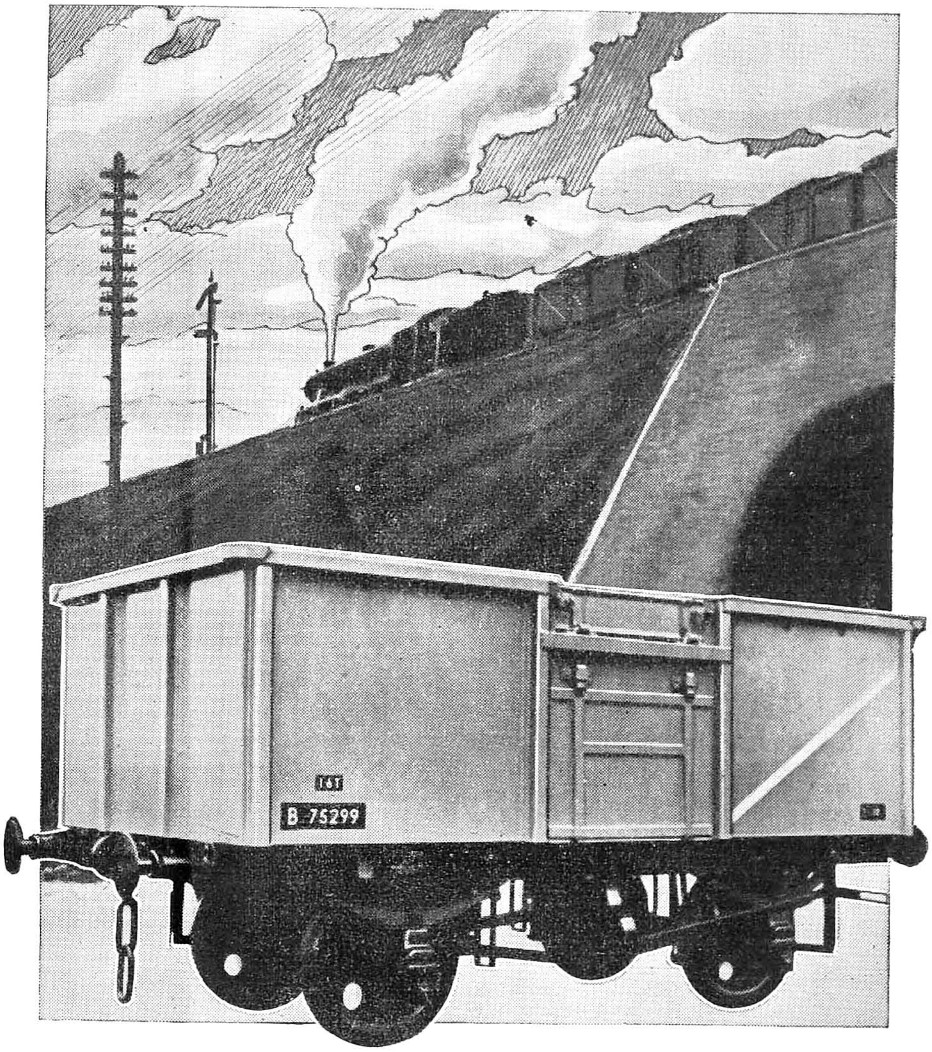
In preparing the Hindi equivalents, care has been taken to retain words from English and other languages which have by usage come to be understood by illiterate passengers or the unlettered members of the trading community in all parts of India, including the South.

For instance, the English words platform and Station Master have been retained in Hindi. The Assistant Station Master will be *Sahayak Station Master.* The booking office will be just *tikat ghar.* Parcel outward and parcel inward are *janewala parcel* and *aanewala parcel* respectively.

---

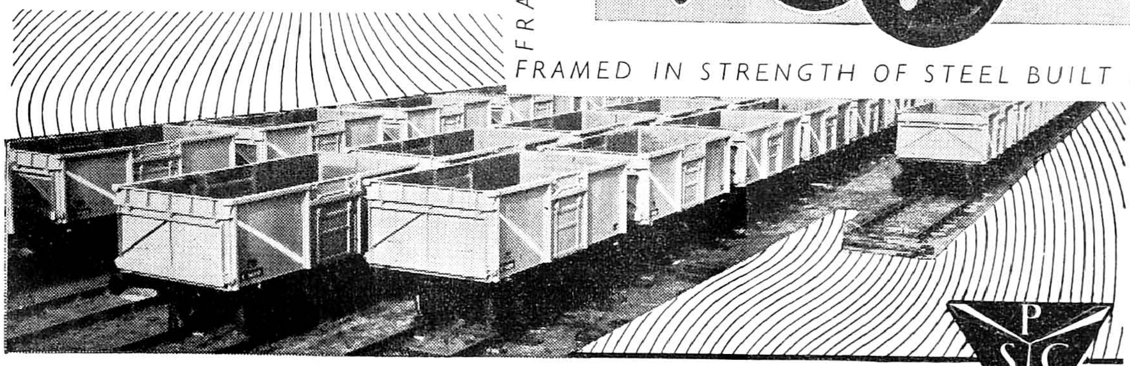
from strength to strength
in steel

FRAMED IN STRENGTH OF STEEL BUILT FOR ENDURING SERVICE



FRAMED IN STRENGTH OF STEEL BUILT FOR ENDURING SERVICE

For enduring service . . . the strength of steel. For design and construction, sound, steadfast and reliable . . . the immense facilities, the engineering experience, the craftsmanship of Pressed Steel Company Limited. Strength added to strength . . . reason enough why over 11,000 of these 16-ton mineral wagons will be Pressed Steel built to the order of British Railways annually. *Pressed Steel Company Limited also manufacture wagons and rolling stock for world railways.*



RAILWAY DIVISION, PAISLEY, SCOTLAND

HEAD OFFICE COWLEY, OXFORD

wagons and rolling stock by **PRESSED STEEL COMPANY LIMITED**

London Office: Sceptre House, 169 Regent Street, W.1.

INTERNATIONAL CONFERENCE ON TOURISM

Plea for Freedom of Tourist Movement

INDIAN DELEGATE ELECTED VICE-PRESIDENT

THE plenary session of the 10th General Assembly of the International Union of Official Travel Organisations which concluded on 25th October, 1955, in Delhi elected Mr.M.Touma, Director-General of Tourism of the Lebanon, as the President for the ensuing year. Shri S. N. Chib, Deputy Secretary, Union Ministry of Transport, and Mr. Bernickar of Austria have been elected Vice-Presidents.

The conference which was in session for about a week examined various aspects of international tourism and made a number of recommendations with a view to promoting the same. These recommendations mainly related to elimination of travel barriers, liberalising customs and visa formalities and relaxation of currency regulations. The conference particularly recommended the adoption of travel code laid down by the European Travel Commission for all its member countries. All the sixteen West European countries who are members of this Commission have adopted a common code of customs and visa regulations with a view to facilitating tourism.

The conference laid great stress on social tourism and recommended that all member-countries should encourage the same by organising Study Tours for students, excursions for employees of middle and lower income groups etc. Creation of official commissions composed of qualified representatives of competent Ministries like Transport, Labour and Education was another recommendation made by the conference. The proposed commission would, according to the recommendations, consider all problems of travel and assess the feasibility of granting subsidies to recognised tourist organisations with a view to promoting social tourism.

It was also decided to examine through special commissions the needs of all member-countries from the tourist point of view. These commissions would respectively collect the necessary documentary material related to tourist problems with a view to advising the United Nations and other national and international bodies on the mode of assistance to be given to the respective countries for tourist promotion.

Russia, Poland, Rumania, Syria and Singapore have been admitted as full members of the IUOTO. This brings the total strength of full membership of the Union to 53. Burma has also signified her intention to join the Union and would announce her decision shortly. Mr. Kharachinkou who attended the General Assembly session on behalf of the Soviet Union said that Russia's entry into the IUOTO was in full accordance with her policy of peace. He pointed out that the " Intourist Organisation " of the Soviet Union had during the past two months received about 5000 tourists from various countries, and added that the Soviet Union was making all efforts, to promote international tourism. Luxemburg and Ceylon have been elected to the Executive Committee which comprises 15 representatives from various countries.

Italy bagged the first prize for the best poster in International Travel Posters Competition sponsored by the Ministry of Transport, while France and Great Britain were awarded prizes for the best photograph poster and the best artistic poster respectively.

The International Travel Research Institute which recommended a comprehensive programme of publicity for promotion of tourism also decided to organise a survey of tourist trends in India and the countries included in its region. The Statistical Officer of the Union Ministry of Transport has been authorised to prepare this survey. According to the recommendation accepted by the General Body, the Asian Travel Commission has been divided into two separate Commissions, one to be sponsored by India and the other by Japan. The Commission sponsored by India would include Pakistan, Africa, Nepal, Burma and Ceylon.

Vienna will be the venue of the next session of the IUOTO General Assembly to be held in 1956.

AN ELECTRO-HYDRAULIC DROP HAMMER

By Obering W. BRAUER, V. D. I.

ELECTRO-HYDRAULIC Drop Hammers were developed during the last War chiefly for use in the Aircraft Industry. They were principally engaged on sheet metal forming and shaping and had rather large table sizes. The maximum distance between the hammer legs was approx. 8′ 2½″ with a corresponding depth of 3′ 11″ and max. daylight of 5′ 11″. The tup weight of such a hammer was 4 tons.

Based on the experience thus gained an oil-hydraulic drop-hammer for die-forging was developed, see fig. 1. Its method of operation and control are quite different from sheet metal forming hammers. For the latter hammers relatively low speeds of 31½″ to 39½″ per second were sufficient and the drop height was comparatively small, and considerably less than required for drop-forging hammers, for which the speed must be much higher in order to allow for rapid blows.

Tup weight for tup weight the energy required for drop-forging is very much greater than for sheet forming and the demands made on a drop-hammer are considerably stronger.

The basic design principles of the electro-hydraulic hammer are similar to a steam or compressed-air drop-stamp, i. e. the tup is lifted by the movement of a piston inside a cylinder and connected by a piston rod. In our case the pressure medium is oil. The diameter of the piston could, however, be kept much smaller by selecting a higher specific pressure and therefore the piston-rod itself could also be reduced to a minimum diameter.

The whole drive is mounted together in one enclosed unit containing the electric motor and the direct-driven oil pump. The cylinder pipe, all valves and sleeves are contained in one casting, see fig. 2. The design also permitted to do without all pipes and pipe connections, as it is a known fact that pipe connections do not stand up to the frequent shocks of a drop hammer. Only one aperture for the piston-rod exists in the top plate and all components are fitted from above so that the danger of leakages is completely eliminated. A simple but robust packing is provided for the emerging of the piston-rod and will last a very long time. In the unlikely event of a rod breaking, it can be replaced easily and quickly by a new rod without letting the oil run out.

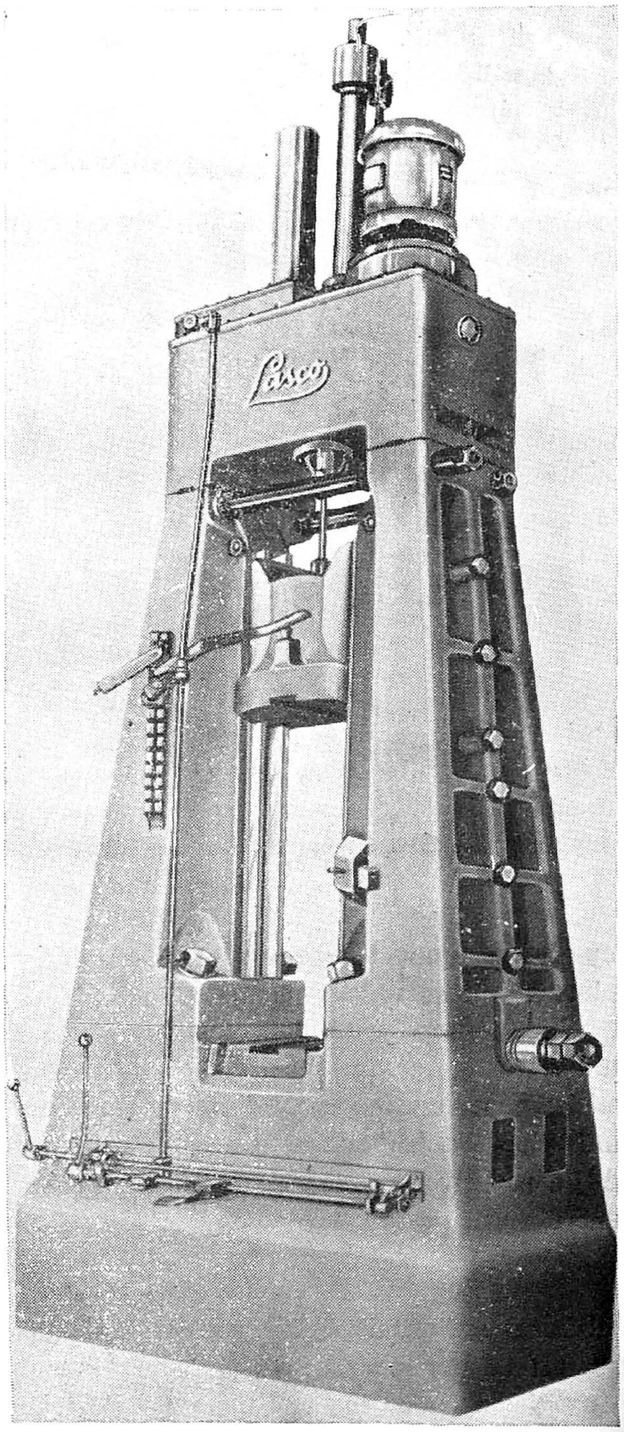


Fig. 1. Electro-oil-hydraulic Drop Forging Hammer with separate V V-guides.

An actual test has shown that a piston-rod can be changed is less than 30 minutes from stopping the motor and starting up again.

A number of reasons existed to select an oil-hydraulic drive. One of the chief reasons was the exceptionally

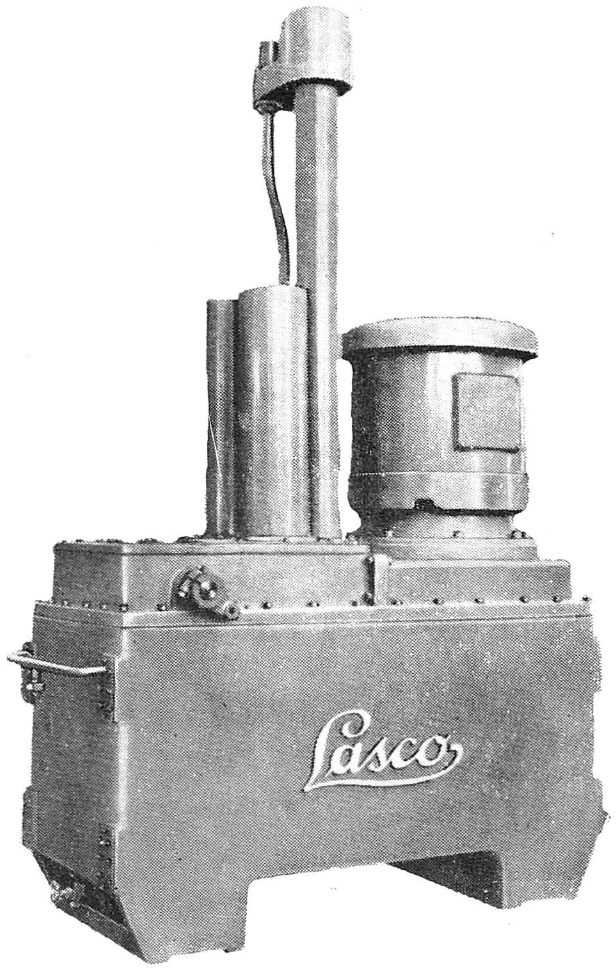


Fig. 2. Completely fitted hammer head.

efficiency of the pump, which was specially designed for this application, rather than rely on existing proprietary pumps. Such pumps with infinitely variable delivery, and suitable for a large output at high pressures were too large to be fitted into the driving head and it is doubtful if they would have been reliable enough bearing in mind the rapidly changing and substantial variations in pressure.

The lifting speed obtained by the oil-hydraulic drive is approx. 11′ 6″ per second. In view of this high speed special provision had to be made to store the oil temporarily during the process of acceleration instead of letting it blow off through safety valves. The lifting speed cannot be uniform over the whole stroke bearing in mind acceleration and deceleration. It reaches temporarily a speed which is considerably higher than calculated from the quantity of oil involved and piston area. This in turn has made it possible to avoid the chief disadvantage of all friction hammers, i. e. loss of energy during acceleration; on the contrary, it was possible to increase the speed of the tup and thereby the number of blows per minute.

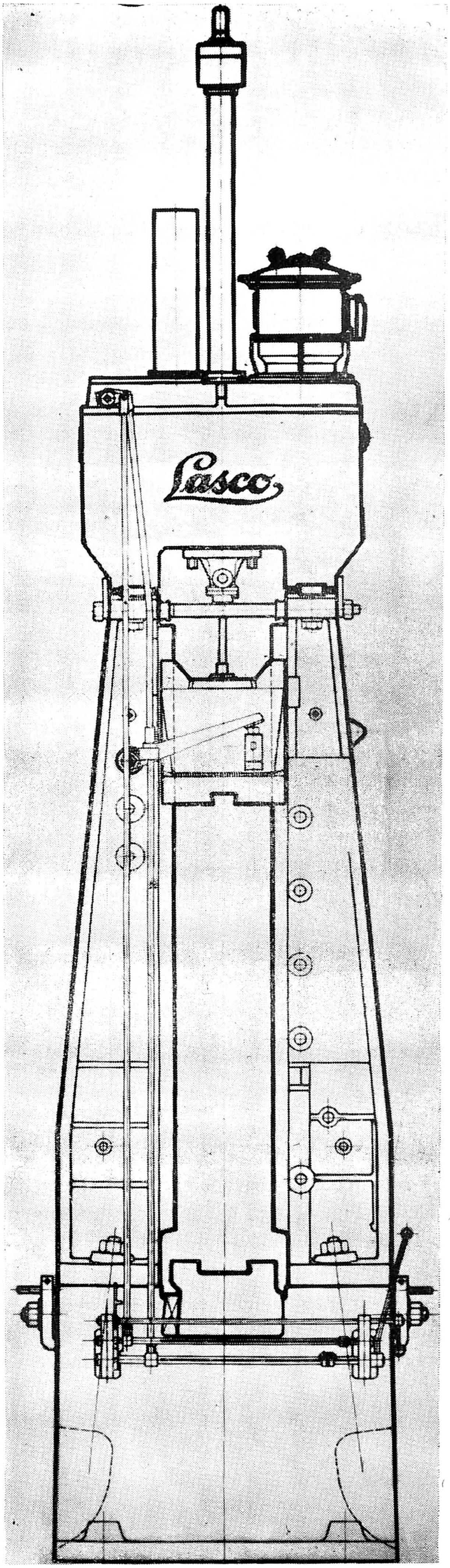
The lifting speed of belt—or board hammers is normally limited, as too great a speed will cause excessive wear and heating up of the driving gear which will render the functioning of the hammer uneconomical. In the case of the oil-hydraulic hammer the opposite applies, in fact it is even necessary to brake the rapidly rising tup by means of an air column in the cylinder above the piston, as otherwise the tup could not be stopped quickly enough after the oil feed has been switched off. As an example, a tup rising at a speed of 11′ 6″ per second would require a distance of approx. $24\frac{1}{2}$″ to come to rest, ignoring friction of losses, which are very low in view of the comparatively large clearances between tup and guides at the top and the thorough lubrication of piston and piston rod. This air cushion above the piston acts also as an accelerator at the commencement of the down stroke by gravity and increases the speed and energy of the blow.

Doubts were raised by experts that in view of the high dropping speed the oil could only leave the cylinder with great losses. Investigations were therefore made on the test bed at Coburg by the Investigating Branch Dept. Drop Forging, Hannover (Director Prof. Kienzle). The result was exceptionally favourable. The average impact speed was only 5% less than the theoretical maximum for a completely free drop. These 5% include the loss caused through friction between tup and guides. During these tests the top of the cylinder was left open in order to eliminate any possible assistance of the air cushion, above the piston.

In practice, the actual impact speed assisted by the air cushion is greater than pure gravity speed. This has been proved by actual experience in all cases where existing board or belt hammers were converted by the fitting of an oil-hydraulic driving head (see figs. 3 and 4). In these hammers anvil block and uprights remained unchanged. With identical drop height and tup weight a greater number of blows could be obtained together with a measurable increase of the strength of the blow so that the saving in stamping time amounted to 20%, to 30% and even 50% in special cases.

A further reason for the high impact speed is the automatic reversing at the bottom of the stroke, without using stops or other mechanical means.

The movement of the tup is reversed merely by the oil which comes to a full stop, i. e. its flow is fully arrested, as soon as the tup strikes. Therefore, the reversing can never occur prematurely and no excessive stresses can be



left : Fig. 3. A Board Drop Hammer converted into an electro-hydraulic Hammer.

set up in the hydraulic control or in the piston rod or in the connection between tup and rod. The reversing takes place irrespective of the height of the dies. It is a very import factor in the contribution to the great reliability of this type of hammer that the operator has no possibility to influence the setting!

The time during which upper and lower die are in contact with each other is therefore extremely short, which is of greatest benefit for reduced die wear.

The ability to control a hammer accurately and quickly is of importance for its efficient use, and a "one-man one-lever" control is provided. In order to obtain a blow of maximum strength and maximum stroke the single foot-pedal is pressed down sharply and released. The tup will drop instantaneously and revert automatically to its top position against a ratchet lever which is adjustable.

For short stroke blows the pedal is pressed down gently which causes the tup to drop slowly. The pedal can either be kept in the required position so that the tup

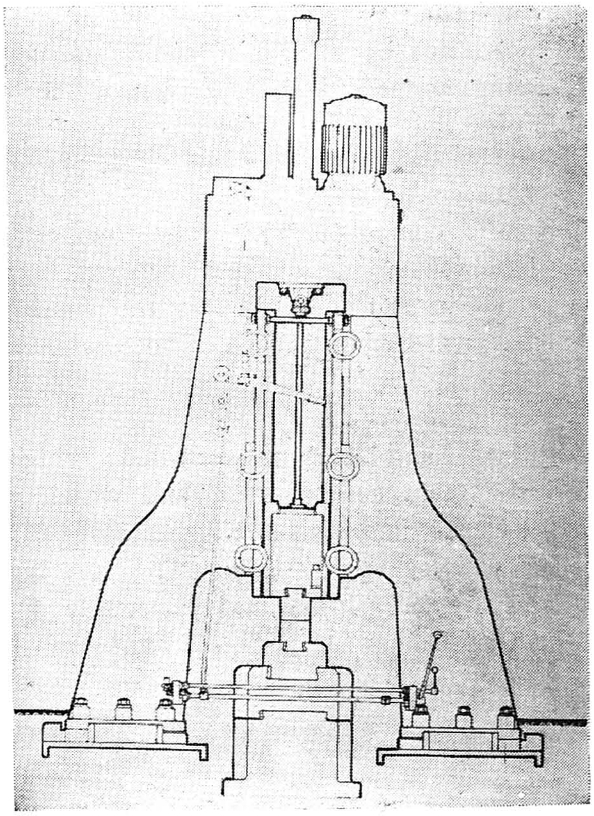


Fig. 4. A Steam Hammer converted into an electro-hydraulic Drop Hammer.

will stop, or alternatively it can be kicked through whereupon the tup will accelerate rapidly, strike and return to starting position. If further short blows are wanted, the pedal can be operated again whilst the tup is lifting. This will cause the tup to drop again from any required position.

Furthermore, if a workpiece has to be cut off the bar after forging the tup need only be lifted a few inches and can drop again gently to separate the forging from the bar. In all cases the tup always returns immediately to its top position after the foot is taken off the pedal.

If a forging requires to be straightened after trimming it can be put back into the hammer die and the tup can be brought down slowly until it comes to rest on the forging without making a blow strong enough to cause a further small flash which may be difficult to remove subsequently except by grinding.

As the process of drop-forging is not everywhere the same and different demands are made on a hammer a different control can be supplied on request which is automatic, similar to the modern board-hammer. With this type of control the tup will move up and down rapidly and continuously as long as the operator keeps his foot on the lever. When the foot is removed the tup will return automatically to its top position and stay at rest until the pedal is pushed down again. The foot pedal need not be fixed but can be moved along the floor, being connected to the control mechanism by a flexible pipe.

The hydraulic control is very easy to operate and saves the hammer operator from fatigue. It also renders a second man unnecessary as the whole range of performance is within easy reach of one man alone.

An additional hand lever is provided which acts directly on the main control shaft and which will be useful for the careful and sensitive handling and adjusting of the tup when changing dies. The tup can thus be raised and lowered slowly and accurately for die-setting and additional outside lifting gear is not required.

DISCUSSION

The discussion which followed the lecture brought to light several interesting points which are briefly mentioned below and which could be supplemented subsequently.

The largest tup weight was stated as 50 cwt but can be increased to 5 tons and more.

Regarding the control lay-out it was pointed out that the first sheet metal forming hammers as used in the Aircraft Industry were provided with electric push-button control which was adjustable as to height, so that by merely pressing a button by hand or foot continuous blows could be given from any height.

The number of blows of oil-hydraulic hammers is very high due to the very great lifting speed and down-stroke acceleration through the air cushion. 40 to 60 blows over the full length of stroke have been obtained for larger hammers, whilst smaller hammers have given 80 to 110 short stroke blows/minute.

Energy consumption is low due to the very efficient working of the pump which is between 0.8 and 0.85. A 20 cwt Hammer has a 22 kw motor but its actual energy requirements are only between 13 and 15 kw. The energy required by comparable hammer size driven by compressed air is considerably higher, by several multiples.

Another question raised the problem of impact speed, i. e. losses caused by the oil column. The favourable results could only be achieved by adopting a design which corresponded less to the principles of oil pressure control, but more to the principles of oil flow which apply to the high speeds which are obtained.

The question is existing hammers could be fitted with the oil-hydraulic drive could be answered in the affirmative. Figs. 4 and 5 show conversions of old-type drop-hammers.

The smallest tup weight for which hydraulic drive is economical is normally 16 cwt, although smaller hammers of 10 cwt capacity have been built.

HOW TO RESERVE ACCOMMODATION

Unless you reserve your berth (I and II Class) or Seat (3rd Class long distance) in advance, you may not be sure of getting accommodation on the train you wish to travel by.

Application should be made to the Station Master of your starting station at least 3 days in advance specifying the date and train by which you intend travelling and the tickets must be bought in advance. The reservation fee leviable is 8 annas per seat or berth.

Reservation by I and II Class from intermediate stations by Express trains can also be made similarly, but reservation ticket can be issued only after getting an advice from the Reservation Centre that the reservation has been made.

Tickets will be issued only if accommodation is available.

If the reserved seats or berths are not occupied at least 5 minutes before the booked departure of the train the reservation will be cancelled and the seat or berth given away to another.

Reservation fee is not refundable.

III Class seats are also reservable on Express and certain other important trains for long distance passengers from the train-starting stations on payment of a reservation fee of four annas per seat.

Do not occupy a berth or seat reserved for another, as you are liable to be displaced at the last moment.

If you find another person occupying the berth or seat reserved for you and if he will not vacate it on demand, report it to the Guard or Station Master. They will help you.

(Inserted in the interests of Travelling Public by the Public Relations Officer, Southern Railways Magazine)

CLEANLINESS LEADS TO HEALTH AND HAPPINESS

Clean orderly habits contribute to general health and welfare and as such to happiness and prosperity; they are more important than medicines.

Cleanliness prevents disease; medicine only attempts to cure.

Cleanliness of the person, of the houses and colonies, reflects discipline in the individual and the community. Discipline is the foundation stone for progress of oneself and the country. Cleanliness is a good habit. It is also cheap.

All Railwaymen should set an example of cleanliness. This will help others and themselves.

Printed and Published by Sri T. S. S. Rao, Public Relations Officer at S. R. Press for the "Southern Railways Magazine", Manojiappa Street, Fort, Tanjore.
Managing Editor : T. S. Krishna Rao.